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MINISTRY OF FORESTS

Quesnel Timber Supply Area

Rationale for Allowable Annual Cut (AAC) Determination

Effective July 1, 2001

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Chief Forester

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Objective of this Document

This document provides an accounting of the factors I have considered and the rationale I have employed as chief forester of British Columbia in making my determination in June 2001, under Section 8 of the Forest Act, of the allowable annual cut (AAC) for the Quesnel timber supply area (TSA). The document identifies where new or better information is needed for incorporation in future determinations. The document also identifies the urgent need for this current determination in view of the recent very rapid spread of the mountain pine beetle in the TSA.

Description of the TSA

The Quesnel TSA is located in the northern part of the Cariboo Forest Region, lying in the Fraser Basin and the Interior Plateau between the Coast Mountains on the west and the Cariboo mountains on the east. To the west of Quesnel and of the Fraser plateau, the TSA includes the Itcha-Ilgachuz mountain ranges and the intervening flat and gently rolling terrain encompassing the Blackwater and Nazko river systems. To the east lie the Quesnel highlands, Barkerville, and the Cariboo River. The climate, terrain and forests of the TSA are varied. West of the Fraser River, a relatively dry climate supports forests predominated by lodgepole pine. East of the Fraser River, the forests receive more rainfall and contain more spruce and balsam. Overall, the TSA is covered by stands of lodgepole pine (85 percent), spruce (10 percent), and Douglas-fir (3 percent) with hemlock and balsam, and deciduous species forming minor components. The Biogeoclimatic Ecosystem Classification (BEC) zones present in the TSA (in descending order by total area in the TSA) are sub-boreal pine-spruce; sub-boreal spruce; montane spruce; Engelmann spruce-subalpine fir; interior Douglas-fir; interior cedar-hemlock; and alpine tundra.

The TSA covers about 1.6 million hectares in total, of which approximately 81 percent—1 301 777hectares—are productive Crown forest.[1] About 290 000 hectares of the productive Crown forest area in the TSA are either used for critical wildlife habitat, wildlife tree patches or riparian reserve areas, or are in areas of environmental sensitivity or low productivity, or support non-merchantable forest types, or for other reasons are unavailable for timber harvesting. About 78 percent of the productive forest, or 63 percent of the total TSA area, is included in the current timber harvesting land base of 1 010 888 hectares.

The TSA is administered by the Ministry of Forests' Quesnel Forest District office in Quesnel. The Quesnel Forest District includes, in addition to the Quesnel TSA, a number of woodlot licence areas and two tree farm licences, numbers 5 and 52. The information provided in this rationale document pertains to the TSA only, unless otherwise specified.

The major population centre in the TSA is the city of Quesnel which, together with the adjacent communities of Red Bluff, Barlow Creek and Bouchie Lake, houses about 8500 of the TSA's total population of 26 000 (1996 Census). Other communities include Wells and Barkerville in the east, and Nazko in the west. The economies of the communities in the TSA are largely resource-based, and the majority are dependent on the local forest

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[1] [N.B.: Due to a typographical error, the *Quesnel Timber Supply Area Analysis Report and Information for Urgent Allowable Annual Cut Increase*, published by BC Ministry of Forests, February 15, 2001, (hereinafter the 'Timber Supply Analysis Report') incorrectly identified the area of productive Crown forest as 1 025 810 hectares (Table 2, p. 22); however, the percentage figures as listed there are correct.]

industry. Ranching, mining and tourism are also integral to communities in the TSA.

The Kluskus Band, the Lhtako-Dene First Nation (Red Bluff Band), Alexandria Band, and the Nazko Band, as well as ten other First Nations communities located outside the TSA, have all asserted traditional territories or interests within the TSA. First Nations are actively involved in the forest industry; First Nations companies hold six non-replaceable sawlog forest licences with an AAC totalling 90,000 cubic metres. Several value-added manufacturing plants are operated by major mills as joint ventures with First Nations companies.

Twelve wood-processing facilities, including lumber mills, veneer and plywood operations, and two log-home operations, are located in the Quesnel area. Their estimated combined annual processing capacity of 2 891 000 cubic metres (based on 480 8-hour shifts per year) exceeds the current AAC of 2 340 000 cubic metres for the TSA. Also located in the Quesnel area are two pulp mills and a medium density fibreboard (MDF) operation, with an estimated total annual capacity (based on 345 24-hour days per year) of 1 120 000 bone-dry units of chips and wood-waste.

Critical issue: Epidemic mountain pine beetle infestation

(This section introduces the considerations presented in detail later under *abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.*)

The Quesnel TSA forms part of a vast area in central British Columbia that is currently infested by the mountain pine beetle (MPB). Most (about 73 percent) of the infestation in the Cariboo Forest Region lies in the Quesnel TSA. In this TSA the mapped area of 'red-attack' has grown from an estimated 33 hectares in 1991 to over 24 400 hectares on the landscape in 2000, after harvesting. The infestation is epidemic in the TSA and now threatens most of the mature and near-mature lodgepole pine stands in the TSA—the majority of the TSA's harvestable and merchantable timber supply. Projections based on the current average rate of spread and on experience gained from an infestation of the MPB in the Chilcotin area in the 1970s and '80s indicate that the current outbreak could infest the majority of the mature and near-mature pine within 7 to 9 years. If suitable conditions persist—that is, with the continued availability of susceptible stands of lodgepole pine, with mild winters and hot summers—the MPB at its peak could affect 80 000 hectares, or about 10 million cubic metres, in one year. It is estimated that during the year 2000 alone, about 2 million cubic metres of merchantable timber were killed by the MPB.

In recent years a number of actions have been tried in the TSA to reduce the rate of spread of the beetle. These methods have met with limited success due to recent mild winters and an absence of sharp, cold spells with temperatures of minus 25 degrees Celsius in early fall or late spring that can decimate the MPB populations and help end serious outbreaks.

It is unclear exactly how long timber damaged by the MPB will be usable for manufacturing lumber, or even pulp. Stands in the Chilcotin are still being harvested 20 years after the infestation there; however, given the climatic conditions in much of the Quesnel TSA, their value could be lost in as little as 5 years. There are also dangers that if affected timber is not logged in a timely way it will become susceptible to fire, further endangering adjacent stands of marketable timber. The severity of the current infestation not only places the future timber supply from much of the TSA in jeopardy, it also

compromises watershed management and places at risk many other forest values, including recreation, biodiversity, landscape aesthetics, cultural heritage, range, fish and wildlife, and possibly residential areas.

In consideration of these risks, immediate action to curtail the spread of the MPB, in addition to the methods attempted to date, is urgently needed. Since accelerated harvesting can help to curtail the beetle's rate of spread to remaining healthy areas of the forest by eliminating its 'brood trees', and can help to recover by salvage at least part of an already rapidly growing and otherwise potentially very large economic loss, an urgent, early review of the AAC for the TSA is now being undertaken.

Expedited process for an urgent AAC determination to address the infestation

Prompt harvesting of stands in which beetles are still present can reduce the rate of spread, conserving forest values and recovering otherwise lost timber resources and Crown revenues. For this reason, to the extent possible, the current AAC is completely dedicated to removing, as a first priority, timber that has already been attacked. Even so, without an increased harvest level, much of the already attacked timber has the potential to become unsuitable for lumber manufacturing. The current AAC does not include sufficient volume to permit additional licences to be awarded to increase the harvest to the level necessary to ensure recovery of the value of the already infested and damaged timber.

In contemplation of the need to provide remedies for this and similar situations, the *Forest Act* (section 8(8)(e)) requires the chief forester, in determining AACs for TSAs, to consider

> abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

In January 2001, both the Quesnel Forest District Manager and the Regional Manager of the Cariboo Forest Region requested an urgent review of the timber supply in the Quesnel TSA, and in particular, early consideration of a possible temporary increase of up to one million cubic metres in the allowable annual harvest level to facilitate contemplated harvest and salvage operations necessary to address the mounting severity of the MPB problem.

In response to these requests, the review of the timber supply for the Quesnel TSA was given a high priority and the review process itself was modified to allow for an early completion. To provide an opportunity for public review under the accelerated schedule, a shortened, 21-day period for public review and comment was provided in place of the normal 60-day period, following the release, on February 15, 2001, of a timber supply analysis report which also served the purpose of a Public Discussion Paper.

Produced under strict time constraints, this analysis report is briefer than many timber supply analysis reports for TSAs. Nonetheless, the report has been integral to my considerations in determining an AAC for the Quesnel TSA since it takes into account a range of important issues including biodiversity, riparian areas, old-growth forest habitats, scenic areas and community watersheds, and specific information on potential changes in the timber supply over time resulting from management responses to the beetle infestation. This report, and several related supplementary analyses with which I have been provided, have helped me to assess the effects of current forest management practices on the supply of wood available for harvesting in both the short (20-year) and long (250-year) terms, as well as the implications of uncertainties about predicted future conditions in the forest.

Having considered the rapid increase in the MPB population in the TSA, as well as the proximity of the infestation to a large area of the beetles' preferred host—mature lodgepole pine—and the potential effects of the infestation on the standing timber inventory, on the future timber supply and on other values in the TSA, I became satisfied that the epidemic indeed poses an immediate and severe risk to the TSA. Having also reviewed the timber supply analysis report, I became further satisfied that an early AAC determination, with particular weight given to considerations under section 8(8)(e) of the *Forest Act*, could be of crucial assistance in remedying some of the serious problems related to the MPB infestation.

On this basis I have proceeded to make such a determination in as timely a manner as possible, giving consideration to all of the land use, forest growth, forest management, social and economic and other factors required by the statute to be considered, with particular weight, under the circumstances described and for the reasons given, placed on my considerations under section 8(8)(e). This rationale statement details the full considerations and reasoning on which my determination is based.

I am indebted to Forest Service staff from the Quesnel Forest District, the Cariboo Forest Region, and the Timber Supply Branch, and to staff of the Ministry of Environment, Lands and Parks, for their professional dedication, under pressure in this abbreviated process, to maintaining the high standards of investigation and presentation that have helped me to make a determination which I am confident is supported by the best available information.

History of the AAC

The AAC for the Quesnel TSA was first established in 1981, at 2.3 million cubic metres. In 1985 a severe MPB epidemic swept across the Chilcotin Plateau to the south and the AAC for the Quesnel TSA was increased by 50 percent to 3 450 000 cubic metres. The beetle infestation was subdued in 1984 and 1985 by extremely cold early winter weather, and, although the infestation in the Quesnel TSA never reached the high levels experienced in the Chilcotin area, the AAC increase (through a licence that expired in 1990) allowed a consortium of local licensees to harvest trees under attack and to salvage forest stands killed by beetles. In 1989, the AAC for the TSA was increased by 50 000 cubic metres to accommodate a 'partition' for harvesting attributable to deciduous species. In 1990, when TFL 52 was removed from the TSA, the AAC for the remaining area of the TSA was determined at 2 450 000 cubic metres. This included 400 000 cubic metres attributable to harvesting in 'problem forest types' (PFTs); in 1992 this partition was reduced to 300 000 cubic metres for a total AAC of 2 350 000 cubic metres.

Effective January 1, 1996, the AAC was determined at 2 340 000 cubic metres, of which 1 965 000 cubic metres were attributable to conventional sawlogs, 300 000 were attributable to PFTs, and 40 000 cubic metres were attributable to deciduous species. In addition, 34 500 cubic metres were identified as the woodlot licence component of the AAC for the TSA. This latter component is required under the *Forest Act* to be administered separately from the AAC for the TSA, as noted immediately below and discussed further in the section *woodlot licences*.

I am advised by the Quesnel Forest District Manager that the AAC for the TSA is usually fully harvested every year with the exception of the deciduous partition, for which there is limited demand.

The AAC is currently apportioned as follows:

Form of Agreement	Total cubic metres	Percentage of AAC
Forest Licence, replaceable	1 448 647	61.91
Forest Licence, non-replaceable	384 600	16.44
Replaceable Timber Sale Licences	5681	0.24
Small Business Forest Enterprise Program, (SBFEP) Non-Renewable Forest Licences	115 000	4.92
SBFEP, Category 1 (Section 20)	111 718	4.77
SBFEP, Category 2 (Section 20)	23 000	0.98
SBFEP Bid proposals, (Section 21)	143 623	6.14
Woodlot Licences *	62 731	2.68
Forest Service Reserve	45 000	1.92
Total	**2 340 000**	**100.00**

* When woodlot licences are issued the volumes so allocated must be removed from the apportionment for woodlots in the AAC for the TSA, and must be administered separately from the AAC for the TSA as required by the *Forest Act*. The separate administration required for woodlots is taken into account in this AAC determination as discussed in the section *woodlot licences*.

New AAC determination

Effective July 1, 2001, the new AAC for the Quesnel TSA will be 3 248 000 cubic metres per year. Of this total AAC, 300 000 cubic metres are attributable to problem forest types as defined by the Quesnel Forest District Manager, and 20 000 cubic metres are attributable to deciduous species. This AAC volume excludes all volumes in issued woodlot licences. This new AAC will remain in effect until another new AAC is determined, which must take place within five years of the present determination.

The following observation is important to, and forms an integral part of this determination. Staff of the BCFS will monitor and apprise the chief forester of the condition of the mountain pine beetle infestation, on the understanding that, if and when required, this determination may be revisited at a date earlier than required by statute.

Information sources used in the AAC determination

- *Quesnel Timber Supply Area: Rationale for AAC Determination*, January 1996;
- *Quesnel Timber Supply Area Timber Supply Review Data Package and Information Package*, June 1999;
- *Quesnel Timber Supply Area Analysis Report and Information for Urgent AAC Increase*, February 2001;
- *Cariboo- Chilcotin Land Use Plan Integration Report*, 1998;
- CCLUP Biodiversity Conservation Strategy, 1996;
- Cariboo Region Landscape Unit Planning Strategy, 1999;
- CCLUP Caribou Strategy Committee Update 1998;
- Forest Inventory Planning file, British Columbia Forest Service (BCFS);
- Quesnel TSA licensee Forest Development Plans;
- Major Licence Silviculture Information System records; BCFS;

- *Quesnel TSA Inventory Audit*, BCFS Resource Inventory Branch, 1999;
- *Forest Practices Code Managing Identified Wildlife Guidebook*, 1999, Ministry of Environment, Lands and Parks (MELP) and BCFS;
- Letter from the Minister of Forests to the chief forester, dated July 28, 1994, stating the Crown's economic and social objectives for the province;
- Memorandum from the Minister of Forests to the chief forester, dated February 26, 1996, stating the Crown's economic and social objectives for the province regarding visual resources;
- Letter from the Deputy Ministers of Forests and Environment, Lands and Parks, dated August 25, 1997, conveying government's objectives regarding the achievement of acceptable impacts on timber supply from biodiversity management;
- *A Protected Areas Strategy for British Columbia, Provincial Overview Status Report*, April 1996, Land Use Coordination Office;
- *Forest Practices Code Timber Supply Analysis*, BCFS and MELP, February 1996;
- *Forest Practices Code of British Columbia* Guidebooks, BCFS and MELP;
- *Higher Level Plans: Policy and Procedures,* BCFS and MELP, December 1996;
- *Riparian Management Area Guidebook*, BC, December 1995;
- *Landscape Unit Planning Guide* BCFS and MELP, March 1999;
- *Forest Practices Code of British Columbia Act*, July 1995;
- *Forest Practices Code of British Columbia Act: Regulations and Amendments*, April 1995;
- CCLUP 90-Day Implementation Report;
- Technical review and evaluation of current operating conditions through comprehensive discussions with staff of the BCFS and MELP at the AAC determination meeting held in Quesnel, BC, March 15-16, 2001.

Role and limitations of the technical information used

Section 8 of the *Forest Act* requires the chief forester to consider biophysical as well as social and economic information in AAC determinations. A timber supply analysis, and the inventory and growth and yield data used as inputs to the analysis, typically form the major body of technical information used in AAC determinations. Timber supply analyses and associated inventory information are concerned primarily with biophysical factors—such as the rate of timber growth and definition of the land base considered available for timber harvesting—and with management practices.

However, the analytical techniques used to assess timber supply are necessarily simplifications of the real world. There is uncertainty about many of the factors used as inputs to timber supply analysis due in part to variations in physical, biological and social conditions, although ongoing science-based improvements in the understanding of ecological dynamics will help reduce some of this uncertainty.

Furthermore, technical analytical methods such as computer models cannot incorporate all of the social, cultural and economic factors that are relevant when making forest management decisions. Therefore, technical information and analysis do not necessarily provide complete answers or solutions to forest management problems such as AAC determinations. The information does, however, provide valuable insight into potential impacts of different resource-use assumptions and actions, and thus forms an important component of the information required to be considered in AAC determinations.

In determining the AAC for the Quesnel TSA, I have considered known limitations of the technical information provided, and I am satisfied that the information provides a suitable basis for my determination.

Statutory framework

Section 8 of the *Forest Act* requires the chief forester to consider particular factors in determining AACs for timber supply areas and tree farm licences. Section 8 is reproduced in full as Appendix 1.

Guiding principles for AAC determinations

Rapid changes in social values and in our understanding and management of complex forest ecosystems mean that there is always some uncertainty in the information used in AAC determinations. In making a large number of determinations for many forest management units over extended periods of time, administrative fairness requires a reasonable degree of consistency of approach in incorporating these changes and uncertainty. To make my approach in these matters explicit, I have set out the following body of guiding principles. If in some specific circumstance it may be necessary to deviate from these principles, I will provide a detailed reasoning in the considerations that follow.

Two important ways of dealing with uncertainty are:

(i) minimizing risk, in respect of which in making AAC determinations, I consider the uncertainty associated with the information before me, and attempt to assess the various potential current and future social, economic and environmental risks associated with a range of possible AACs; and

(ii) redetermining AACs frequently, to ensure they incorporate current information and knowledge—a principle that has been recognized in the legislated requirement to redetermine AACs every five years. The adoption of this principle is central to many of the guiding principles that follow.

In considering the various factors that Section 8 of the *Forest Act* requires me to take into account in determining AACs, I attempt to reflect as closely as possible operability and forest management factors that are a reasonable extrapolation from current practices. It is not appropriate to base my decision on unsupported speculation with respect either to factors that could work to *increase* the timber supply—such as optimistic assumptions about harvesting in unconventional areas, or using unconventional technology, that are not substantiated by demonstrated performance—or to factors that could work to *reduce* the timber supply, such as integrated resource management objectives beyond those articulated in current planning guidelines or the Forest Practices Code.

The *Forest Practices Code of British Columbia Regulations* were approved by the Lieutenant Governor in Council on April 12, 1995, and released to the public at that time. The *Forest Practices Code of British Columbia Act* was brought into force on June 15, 1995.

Although the Code is now fully implemented following the end of the transition period on June 15, 1997, the timber supply implications of some of its provisions, such as those for landscape-level biodiversity, still remain uncertain, particularly when considered in combination with other factors. In each AAC determination I take this uncertainty into account to the extent possible in context of the best available information.

As British Columbia progresses toward the completion of strategic land use plans, the eventual timber supply impacts associated with land-use decisions resulting from the various planning processes—including regional plans, the Protected Areas Strategy, and

Land and Resource Management Planning (LRMP) process—are often discussed in relation to current AAC determinations. Since the outcomes of these planning processes are subject to significant uncertainty before formal approval by government, it has been and continues to be my position that in determining AACs it would be inappropriate to attempt to speculate on the timber supply impacts that will eventually result from land-use decisions not yet taken by government. Thus I do not account for possible impacts of existing or anticipated recommendations made by such planning processes, nor do I attempt to anticipate any action the government could take in response to such recommendations.

Moreover, even where government has made a formal land-use decision, it may not always be possible to fully analyze and account for the consequent timber supply impacts in a current AAC determination. In many cases, government's land-use decision must be followed by a number of detailed implementation decisions. For example, a land-use decision may require the establishment of resource management zones and resource management objectives and strategies for these zones. Until such implementation decisions are made it would be impossible to fully assess the overall impacts of the land-use decision. Nevertheless, the legislated requirement for five-year AAC reviews will ensure that future determinations address ongoing plan implementation decisions. However, where specific protected areas have been designated by legislation or by order in council, these areas are deducted from the timber harvesting land base and are no longer considered to contribute to the timber supply in AAC determinations.

The Quesnel TSA lies within the area covered by the Cariboo Chilcotin Land-Use Plan (CCLUP). Forest development in the TSA is required to be consistent with aspects of the plan that incorporate Higher Level Plan (HLP) direction as provided under the Forest Practices Code. The Cariboo Mid-Coast Interagency Management Committee (CMCIAMC) and the Cariboo Chilcotin Regional Resource Board (CCRB) are mandated by government to monitor the implementation of the CCLUP. The CMCIAMC and CCRRB provide advice to the FPC statutory decision makers regarding the best information available with respect to consistency with the CCLUP. The Statutory Decision Makers periodically inform licensees on how they will consider this advice or information in operational plan decisions. The timber supply analysis and my considerations in this AAC determination assume consistency with the direction from the Statutory Decision Makers to licensees as representative of current management.

Forest Renewal British Columbia funds a number of intensive silviculture activities that have the potential to affect timber supply, particularly in the long term. As with all components of my determinations, I require sound evidence before accounting for the effects of intensive silviculture on possible harvest levels. Nonetheless, I will consider information on the types and extent of planned and implemented practices as well as relevant scientific, empirical and analytical evidence on the likely magnitude and timing of any timber supply effects of intensive silviculture.

Some have suggested that, given the large uncertainties present with respect to much of the data in AAC determinations, any adjustments in AAC should wait until better data are available. I agree that some data are not complete, but this will always be true where information is constantly evolving and management issues are changing. Moreover, in the past, waiting for improved data created the extensive delays that resulted in the urgency to redetermine many outdated AACs between 1992 and 1996. In any case, the data and

models available today are superior to those available in the past, and will undoubtedly provide for more reliable determinations.

Others have suggested that, in view of data uncertainties, I should immediately reduce some AACs in the interest of caution. However, any AAC determination I make must be the result of applying my judgement to the available information, taking any uncertainties into account. Given the large impacts that AAC determinations can have on communities, no responsible AAC determination can be made solely on the basis of a response to uncertainty. Nevertheless, in making my determination, I may need to make allowances for risks that arise because of uncertainty.

With respect to First Nations' issues, I am aware of the Crown's legal obligations resulting from recent decisions in the Supreme Court of Canada. The AAC that I determine should not in any way be construed as limiting the Crown's obligations under these decisions, and in this respect it should be noted that my determination does not prescribe a particular plan of harvesting activity within the Quesnel TSA. It is also independent of any decision by the Minister of Forests with respect to subsequent allocation of the wood supply.

Overall, in making AAC determinations, I am mindful of my obligation as steward of the forest land of British Columbia, of the mandate of the Ministry of Forests as set out in Section 4 of the *Ministry of Forests Act*, and of my responsibilities under the *Forest Practices Code of British Columbia Act*.

The role of the base case timber supply analysis

In considering the factors required under Section 8 of the *Forest Act* to be addressed in AAC determinations, I am assisted by timber supply forecasts provided to me through the work of the Timber Supply Review program for TSAs and TFLs.

For each AAC determination for a TSA a timber supply analysis is carried out by British Columbia Forest Service (BCFS) staff using an information package including data and information from three categories—land base inventory, timber growth and yield, and management practices. Using this set of data and a computer model (FSSIM—'Forest Service Simulator'; in this case for the Quesnel TSA, 'version 3'), a series of timber supply forecasts is produced, reflecting different decline rates, starting harvest levels, and potential trade-offs between short- and long-term harvest levels.

From this range of forecasts, one is chosen which attempts to avoid excessive changes from decade to decade and significant timber shortages in the future, while ensuring the long-term productivity of forest lands. Often termed the 'base case', this serves as a reference forecast, and forms the basis for comparison when assessing the implications of uncertainty for timber supply.

Because it represents only one in a number of theoretical forecasts, and because it incorporates information about which there may be some uncertainty, the base case reference forecast for a TSA is not an AAC recommendation. Rather, it is one possible forecast of timber supply, whose validity—as with all the other forecasts provided—depends on the validity of the data and assumptions incorporated into the computer simulation used to generate it.

Therefore, much of what follows in the considerations outlined below is an examination of the degree to which all the assumptions made in generating the reference forecast(s) are

realistic and current, and the degree to which the resulting predictions of timber supply must be adjusted, if necessary, to more properly reflect the current situation.

These adjustments are made on the basis of informed judgement, using current, available information about forest management, which may well have changed since the original information package was assembled. Forest management data is particularly subject to change during periods of legislative or regulatory change, such as the enactment of the Forest Practices Code, or during the implementation of new policies, procedures, guidelines or plans.

Thus it is important to remember, in reviewing the considerations which lead to the AAC determination, that while the timber supply analysis with which I am provided is integral to those considerations, the AAC determination itself is not a calculation but a synthesis of judgement and analysis in which numerous risks and uncertainties are weighed. Depending upon the outcome of these considerations, the AAC determined may or may not coincide with the base case forecast. Judgements that may be based in part on uncertain information are essentially qualitative in nature and, as such, are subject to an element of risk. Consequently, once an AAC has been determined, additional precision or validation may not be gained in all cases by attempting a computer analysis of the combined considerations to confirm the exact AAC determined.

Base case forecast for the Quesnel TSA

The data package for the Quesnel Timber Supply Area (TSA), on which the timber supply analysis was based, and which includes detailed descriptions of the management practices and the assumptions used to incorporate them into the analysis, was released for public review in June 1999. In response to public input, a number of changes were incorporated in the data package.

In projecting the base case harvest forecast for the Quesnel TSA as published in the February 15, 2001 timber supply analysis, the most recent available assessments were used to describe current forest management, the land available for timber harvesting, and timber yields as described in its Appendix 1, 'Information Preparation for the Timber Supply Analysis'. Because this report is an abbreviated version of the timber supply analysis reports typically completed for the Timber Supply Review, more detailed information on the analysis was made available upon request from the Timber Supply Branch. Because forest management is inherently a long-term undertaking, uncertainty is present in much of the information used in analysing the timber supply. Any base case thus provides only a part of the timber supply picture for a TSA, and should not be viewed in isolation from accompanying sensitivity analysis. In my determination I have considered a number of relevant sensitivity analyses in assessing particular uncertainties, as well as several alternative harvest forecasts, as documented in this rationale statement.

For the Quesnel TSA, a base case harvest forecast was selected to represent the potential timber supply under the *current* management regime; that is, the base case forecast itself does not include any of the implications of the MPB epidemic. These implications for the projected timber supply are considered in detail under 'Abnormal infestations and major salvage programs'—Epidemic mountain pine beetle infestation—(*Forest Act* s. 8(8)(e)), and are further discussed in various sections including 'Impediments to prompt regeneration', Resource management objectives', and 'Alternative harvest flows'.

The current AAC for the Quesnel TSA is 2 340 000 cubic metres. This AAC includes 300 000 cubic metres for problem forest types and 40 000 cubic metres per year for deciduous stands. In the base case projection, a harvest level of 2 340 000 cubic metres per year could be maintained for 19 decades, before declining to a sustained long-term harvest level of 2 200 000 cubic metres per year. In this projection, the current harvest level attributable to problem forest types could be maintained for 9 decades, after which most of the problem forest types would have been harvested once, and the regenerated stands were assumed to be managed and to contribute to the conventional timber supply. The harvest level of 40 000 cubic metres attributable to deciduous stands could only be maintained for the first 130 years.

In general, the timber supply in the TSA independent of implications from the MPB, as projected in this base case analysis, shows a very high level of stability that is confirmed by various sensitivity and other analyses, as will be discussed under 'Alternative harvest flows' and in other sections of this rationale.

For the purpose of determining this AAC for the Quesnel TSA I have relied in part on this base case projection of the timber supply, and also on several other related forecasts, in accordance with my assessments of the validity of the assumptions incorporated in the projections, as discussed in the following sections of this document. In particular, I have relied on a projection designed to incorporate a management response to the currently rapid expansion of the MPB in the TSA, in which the initial harvest level was set one million cubic metres higher than that set in the base case projection (see 'Alternative harvest flows', and 'Epidemic mountain pine beetle infestation'), and on sensitivity analyses applied to this projection as described in my considerations of a number of factors in this document.

In this 'worst-case' projection (which has been slightly refined in the time available since its publication) an initial harvest level of 3 340 000 cubic metres was held for 10 years, followed by a reduction to the current AAC of 2 340 000, held through the second decade. This was followed by a reduction to 2 080 000 cubic metres (not 2 070 000 as published in the analysis) which was held for a mid-term period until the fourteenth decade (not the sixteenth as published). At this point the projected harvest level rose to the steady long-term level of 2 200 000 cubic metres as in the base case.

Consideration of factors as required by section 8 of the *Forest Act*

Section 8 (8)

In determining an allowable annual cut under this section the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

(a) the rate of timber production that may be sustained on the area, taking into account

(i) the composition of the forest and its expected rate of growth on the area

Land base contributing to timber harvest

- general comments

The total area of the Quesnel TSA, as estimated from BCFS inventory data updated to December 31 1998 and reported in the February 2001 timber supply analysis is 1 603 111 hectares. Of this, 1 301 777 hectares are productive Crown forest land. [Please

note a typographical error in the former figure of 1 025 810 hectares published in Table 2 of the timber supply analysis.]

As part of the process used to define the timber harvesting land base for a TSA, (i.e. the area estimated to be economically and biologically available for harvesting), a series of deductions is made from the total area of the productive forest. These deductions account for factors that effectively reduce the suitability or availability of the productive forest for economic, ecological or social reasons (e.g. parks). In timber supply analysis, assumptions, and if necessary, projections, must be made about these factors, prior to quantifying appropriate areas to be deducted from the productive forest, in order to derive the timber harvesting land base.

In the Quesnel TSA, a total of 290 889 hectares, or 22.3 percent of the productive Crown forest is currently used to provide critical wildlife habitat, wildlife tree patches, riparian reserve areas, roads, trails and landings, or lies in areas of environmental sensitivity or low productivity, or supports non-merchantable forest types, or for other reasons is unavailable for timber harvesting. These areas—as detailed in the analysis report and summarized in Table 2 (page 22) of the report—were deducted from the total productive Crown forest area in deriving the current timber harvesting land base. As a result, 77.7 percent of the productive forest, or 63.1 percent of the total TSA area is included in the current timber harvesting land base of 1 010 888 hectares. My considerations respecting the individual deductions applied in deriving the timber harvesting land base are presented in the following sections.

- physical and economic operability

Those portions of the productive forest in a TSA which are not physically accessible for harvesting or which are not feasible to harvest economically are typically excluded in deriving the timber harvesting land base. In the Quesnel TSA, forest district staff have conducted a review of areas which may be considered physically inoperable with today's logging methods and have determined that over the entire productive forest in the TSA, approximately 2000 hectares are estimated to lie in areas with slopes greater than 60 percent, some of which may not be physically operable. This potentially 'inoperable' portion of the productive forest area in this TSA is very small in comparison with the proportion of inoperable forest in many management units. In the timber supply analysis, in view of this and of the general stability projected in the timber supply, no specific deduction was made for inoperable areas.

District staff consider this estimate of inoperable area to be preliminary and requiring further investigation. In public input to this determination, First Nations expressed the view that by considering a number of cited land use factors it should be possible to assess whether the timber harvesting land base has been over- or underestimated. Neither district staff nor I disagree with this view and many of the considerations documented in this rationale address those assessments specifically. In addressing the particular question of the size of the operable land base as defined by physical and economic accessibility in relation to steep slopes, I have reasoned as follows.

Since the identified area in question is small to begin with—amounting to about 0.2 percent of the timber harvesting land base—and since it is likely that some of the steep slope areas have already been deducted as environmentally sensitive areas in deriving the

timber harvesting land base, I conclude that the absence of a specific deduction for inoperable areas in the analysis was appropriate and has not led to any significant overestimation in the timber supply. However, it is possible that further investigation may reveal more specific information on this factor, and if necessary any (likely small) consequent land base adjustment may be accounted for in the next determination.

- alienations from Provincial Forest

Between 1995 and 1999 a total of 654 hectares were removed from the Provincial Forest in the TSA for agricultural and other purposes. Applying the overall ratio for the TSA of 77.7 percent timber harvesting land base to productive forest permits a reasonable inference that about 508 hectares of this would formerly have lain in the timber harvesting land base. However, this area was not deducted in deriving the timber harvesting land base used in the timber supply analysis and all of the forecasts have therefore overestimated the timber supply by this very small amount. Considered separately, the implications for the timber supply of such a small area relative to whole timber harvesting land base appear insignificant in comparison to those currently contemplated to arise from the MPB infestation, as discussed under that section below. Nonetheless, in AAC determinations it is sometimes possible for individually insignificant implications arising from a number of factors under consideration to combine into an effect which may have significance for the overall timber supply. Therefore, since this area is reasonably well quantified, in the interest of reducing uncertainty wherever possible, in my determination I have taken into account with several other necessary land base adjustments the need for deduction of 508 hectares and a consequent minor overestimation in the analysis of the timber supply, affecting the mid and long terms as noted in 'Reasons for Decision'.

- environmentally sensitive areas

An environmentally sensitive area (ESA) is an area identified during a forest inventory that is sensitive to disturbance—such as unstable terrain or areas that are difficult to reforest—or is significantly valuable for fisheries, wildlife, water or recreation resources. ESA values are used to exclude areas from the timber harvesting land base where more specific and detailed information is not available about a particular forest resource. Areas may be identified as either highly or moderately sensitive to disturbance, and are either entirely or partially excluded from the timber harvesting land base, according to their level of sensitivity.

In deriving the timber harvesting land base for the Quesnel TSA timber supply analysis, the exclusions applied for various sensitivities were as follows. Areas with highly sensitive soils were 90-percent excluded; moderately sensitive soils were 50-percent excluded; and areas with a high avalanche hazard were excluded 90 percent. Land base exclusions were not applied for wildlife areas; instead the necessary forest cover requirements and harvesting restrictions were applied in the analysis to the appropriate areas. In accounting for ESAs for sensitive soils and avalanche areas, areas totalling 8918 hectares, or 0.7 percent of the Crown productive forest land, were excluded from the timber harvesting land base.

The exclusions for sensitive soils and avalanche areas were based on information from the TSA inventory file updated to December 31, 1998. Terrain stability mapping in the Quesnel Forest District has been concentrated to date on the tree farm licences in the

district, with only limited mapping carried out in the TSA. When more mapping is completed, and new information becomes available for the TSA, any implications for timber supply will be assessed in a future analysis. District staff expect the more detailed terrain stability information to replace the ESA data over time. The ESA exclusions and mapping were reviewed by BCFS staff in collaboration with staff of the MELP. For the current determination, in my experience the percentage deductions applied in the analysis are within a reasonable range. They were applied to areas generated from the provincial inventory system, which represents the best available information at this time. I am therefore satisfied that the land base exclusions for sensitive areas as modelled in the analysis are acceptable for use in this determination.

- sites with low timber productivity

In the analysis for the Quesnel TSA, timber volumes on sites with productivities (for definition, see below, *- estimates for site productivity*) that were considered to be below certain levels were excluded from contributing to the timber harvesting land base. To derive the appropriate cut-off values for low productivity by inventory type group, district staff reviewed the merchantability of the volumes generated in the timber supply analysis by the 'Table Interpolation Program for Stand Yields' (TIPSY) model used for managed forest stands, both for natural and planted stands, with site indices ranging from 5 to 14 metres. In this review, the feasibility of harvesting stands on specific sites was assessed by factors which included growth rates and the minimum volumes and diameters projected to be produced over a reasonable growing period for each species.

The site index that most closely approximated the production of 150 cubic metres per hectare in 150 years was selected for spruce, pine, Douglas-fir and balsam species. For stands subject to non-clearcut silvicultural systems (e.g. selection-harvested Douglas-fir stands) periods up to 300 years were selected to reflect the longer rotation ages expected for mule-deer and caribou habitat management.

As a result, low productivity was defined for the leading species in the various inventory type groups by the following minimum site index requirements: Douglas-fir, 9 metres; balsam, 7 metres; spruce, 7 metres; lodgepole pine, 7 metres; deciduous species, 8 metres; and problem-forest-type pine, 7 metres. All stands with a logging history were included in the timber harvesting land base regardless of site index.

The original assessment indicated that a site index of 9 metres at age 50 would be required for lodgepole pine to reach 150 cubic metres in 150 years. However, harvesting has occurred in stands where the inventory indicates a lower site index of 8, and measurements suggest that site indices in second growth stands will in fact be higher than indicated in the inventory. District staff therefore consider that a more realistic identifier of low site productivity for lodgepole pine is given by a site index of less than 7 metres at age 50. The change from site index 9 to site index 7 for lodgepole pine included 4689 hectares that would otherwise have been excluded from the timber harvesting land base.

Overall, the exclusion of areas of so-defined low site productivity resulted in a reduction of 16 667 hectares of productive forest or 1.3 percent of the Crown forest land from the timber harvesting land base. (A further exclusion of 14 908 hectares of low-productivity, predominantly deciduous stands is noted below under - *deciduous forest types*.)

In public input, the forest industry expressed concern that the exclusions appear to be based not on current performance but on an 'estimated' feasibility of operations, and that if performance is shown in stands with productivities lower than the cut-off, this should be reflected in deriving the timber harvesting land base. In fact, all stands with a logging history have been included, regardless of site index.

Licensees have also suggested that in view of the recent findings from the Old-Growth Site Index (OGSI) and other site index studies it is possible that some misclassified areas were inappropriately excluded. However, I note that only harvested stands are eligible for OGSI adjustment, and therefore the performance criteria noted above appear appropriate. Also, the current method of definition is more accurate than that used in the previous timber supply review ('TSR1'), in which the general inventory variable site class 'poor' was used with area-inclusion factors developed in the late 1980s. Current assessments are based on the more specific site index value. Moreover, considering the slower growth rates in unmanaged stands, the application of the managed-stand cut-off criteria to both managed and unmanaged stands is likely to have included more rather than less marginal area.

In my experience the deduction for low-productivity sites in this TSA is not large, and in fact could conceivably have included some sites of questionable productivity. I consider the methodology for defining the 'low-site' cut-off value to be reasonable, and I accept the exclusions so made as adequate for use in the analyses used to inform this determination.

- problem forest types

The AAC for the Quesnel TSA currently includes 300 000 cubic metres attributable to 'problem forest types' (PFTs). In the 1996 AAC determination, 236 237 hectares of PFTs were identified, defined as all stocking class 4 pine stands and pine stands with an average harvestable tree size of between 0.1 and 0.2 cubic metres. In the December 1994 timber supply analysis the PFT land base was defined not by forest stand polygon, but by supply block, species, age class, height class, stocking class, site class and an inclusion factor for the percentage of PFT. As noted in the 1996 AAC rationale document, the definition and the extent of problem forest types in the TSA were subject to considerable uncertainty.

To assist in estimating the size of the PFT land base in preparation for the 2001 determination, a consulting firm was contracted to provide updated information from inventory attributes for the pine forest types in the Kluskus and the Narcosli East and West Supply Blocks. The study estimated that there are 130 000 hectares of pine PFT forest in the Kluskus and the Narcosli East and West Supply Blocks, and that the PFT was found in stands with a high composition (80 percent and over) of pine.

In July 2000, the Regional Manager agreed that the 1995 PFT definition, modified to include only predominantly pine stands in the Kluskus and the Narcosli East and West Supply blocks, would be adequate for use in the current timber supply analysis. It was noted that in the field, PFTs are still defined on the basis of a piece size between 0.1 and 0.2 cubic metres. Based on the modified 1995 definition, the PFT land base derived in the analysis was 139 000 hectares. This figure approximates the consultant's estimate and is considered by district staff to reasonably reflect the actual PFT land base. In the base case projection (without MPB implications) the current harvest level of 300 000 cubic metres attributable to PFTs could be maintained for 90 years.

Licensees questioned the reduction of the size of the PFT timber harvesting land base over time. District staff note that the PFT area was reduced in accordance with the results of an inventory project which showed that some of the PFT areas are now occupied by spruce rather than pine and that some pine stands no longer fit the definition of PFT. They note that the PFT land base was reduced for consistency with inventory updates for species and stocking class, and that areas that are no longer within the PFT land base are now included in the main timber harvesting land base.

Three mills in the TSA depend in whole or in part on the PFT harvest. Licensees have suggested that the management of PFTs needs to be integrated with any initiative taken to deal with the MPB infestation, and an increase in the allowable PFT harvest has been suggested. Since a significant increase in the AAC for the TSA is currently proposed as a means of managing certain aspects of the infestation, in considering the advisability and feasibility of such an increase I have also contemplated the suitability of a simultaneous increase in the PFT harvest level. Licensees have been reviewing PFT harvest opportunities and have outlined a rationale for an increased PFT harvest. I have considered this rationale and related information as follows.

It is suggested that a higher PFT harvest could be used to offset a potentially significant future AAC reduction or 'falldown' upon the conclusion of an accelerated harvest of infested timber. In isolation from other considerations, the fact that the current allowable harvest level of 300 000 cubic metres per year for PFTs could be maintained for 90 years in the base case projection would appear to indicate that there is some flexibility to adjust the PFT harvest level. A 1998 report for the Timber Investments Strategy Committee, Cariboo Forest Region, supports this view, indicating the possibility of increasing the short-term harvest level by prioritizing PFT stands.

From this, it may appear at first sight theoretically feasible to increase the PFT harvest to offset a future reduction as suggested. However, in practice, the outcomes of a higher PFT harvest must be consistent with management objectives for the range of forest values in the TSA under the conditions that will exist in future if and when the need for such an offset is indicated. This consistency would be difficult or impossible to assess reliably at present—whether the increase were to be implemented now or at the time of such an offset—since it is extremely difficult to predict the responses of the currently catastrophic MPB infestation both to management by an accelerated harvest and to unknown future weather conditions in the TSA. The duration of a possible AAC uplift and the resulting implications for timber supply and for other forest values are currently subject to a level of uncertainty that will only be reduced as operational experience is gained in managing the MPB.

For these reasons, and considering that the PFT pine is less vulnerable to the MPB, I conclude that basing a PFT harvest increase at this time on the premise of offsetting a future AAC reduction would be premature. I am concerned also that an increase in the PFT harvest simultaneously with a significant increase in the overall AAC could compound management and administrative difficulties likely to be experienced in dealing with the infestation. In my judgement, the range of forest management objectives in the TSA is more likely to be met over time without an increase at this time in the PFT harvest level.

In deciding on a suitable harvest level for PFTs I have considered the fact that one licensee who has demonstrated harvest performance in PFTs has an underutilized mill capacity for small wood and wishes to secure an additional, stable fibre source, and that the extent of the PFT land base, considered independently of MPB implications, suggests it could be possible to increase the PFT harvest level despite its reduced size. However, in reviewing this component of the harvest, I do not consider it appropriate to expand the use of PFT volumes while a substantial increase in the overall harvest level is being contemplated, particularly when attendant risks to other forest values must be carefully managed. By not increasing the PFT harvest rate now, more of these stands will be present later to offset mid-term risks. Moreover, PFT stands, being often younger and smaller in diameter, are less susceptible than other pine forest types to attack by the MPB, and thus may have a potential to contribute to biodiversity values. If the MPB should become susceptible to attack, it is assumed that the PFT harvest will be directed to attacked stands. From these considerations, as noted in 'Reasons for Decision', I have concluded at this time to maintain the allowable harvest attributable to PFTs at the current level of 300 000 cubic metres per year.

- non-merchantable species and residual forest types

non-merchantable species: In deriving the timber harvesting land base for the analysis, certain forest types described by particular inventory type groups were included or excluded in accordance with their merchantability as defined by cruise data and current harvesting performance in the TSA. Two exceptions were noted: deciduous types were included despite a lack of harvesting, in order to allow for an assessment of their potential for contributing to the timber supply; and 2033 hectares of cedar were inadvertently removed during the analysis.

In consequence, a total of 64 094 hectares of non-merchantable types—4.9 percent of the Crown forest land in the TSA—were excluded from the timber harvesting land base.

I have reviewed the species included and excluded, and I am satisfied that current practice is adequately represented in the analysis in this respect, with the exception of the removal of the cedar land base, which I have reviewed at the end of this factor.

residual types: Residual forest types are represented in the inventory file by polygons showing a history of disturbance from logging or wildfire. Areas with disturbance levels between 26 and 75 percent are considered unmerchantable.

A total of 2406 hectares of productive forest—0.2 percent of the Crown forest land in the TSA—were excluded in deriving the timber harvesting land base, to account for residual types. In an attempt to confirm the validity of this exclusion, 261 hectares of the residual area polygons were reviewed on mapsheets. However, no objective findings could be made from this review, and further investigation of the actual extent of residual types is required.

In public input, licensees criticized the exclusion of stands of predominantly cedar/ hemlock, predominantly balsam, spruce/deciduous mixed stands, lodgepole pine/deciduous mixed stands, and residual types, since evidence exists of harvesting performance in many of these types of stands. Consequently district staff reviewed the forest inventory to

determine the area of various inventory type groups (both mature and immature) that were excluded in deriving the timber harvesting land base for the 1994 analysis. The timber harvesting land base derived for that analysis was approximately the same size after exclusions as in the 2001 analysis. From this, district staff conclude that a similar total area of non-merchantable forest types is likely to have been excluded in the current analysis and, following discussions with licensees, district staff cannot support the evidence provided as sufficient to warrant inclusion of the additional types. While many other variables also affect the size of the harvestable land base, I am prepared to accept the conclusion of district staff on this issue in recognition of the relatively high proportion (77.7 percent) of the Crown forest land already included in the timber harvesting land base.

Nevertheless, as noted above it is agreed that the predominantly cedar types should have been included as merchantable. In my determination therefore, as discussed in 'Reasons for Decision', I have accounted for an underestimation in the timber supply analysis associated with the inadvertent removal of 2033 hectares of cedar.

- deciduous forest types

Deciduous forest types are those stands dominated by deciduous, broad-leaved species. To date, utilisation of the predominantly deciduous stands in the Quesnel TSA has been very limited; no specific licences have been issued for deciduous species, although minor volumes of deciduous species are occasionally harvested from predominantly coniferous stands. Some birch has been utilized but birch volumes represent only 10 percent of the deciduous species profile.

My rationale for the January 1, 1996 AAC determination for this TSA included a request for better assessment of the availability and merchantability of deciduous stands. A re-inventory of a portion of the TSA, completed in 1997, has provided improved information for assessing the deciduous component in the TSA.

In the current timber supply analysis, only coniferous species contributed to coniferous timber supply and only deciduous species contributed to deciduous timber supply. After accounting for low-productivity, some deciduous stands no longer met the minimum volume requirements for merchantability and were excluded from the timber harvesting land base. In all, a total of 14 908 hectares of low-productivity deciduous stands, representing 1.1 percent of total Crown forest land, were excluded. Without accessing some of these excluded low-productivity deciduous stands, the current allowable deciduous harvest level of 40 000 cubic metres could not be maintained beyond 130 years.

In public input, licensees submitted that a significant proportion of the existing merchantable deciduous stands will convert naturally to predominantly coniferous stands through succession, and that in the analysis it would have been more appropriate to model a deferral of harvest, with an appropriate regeneration delay, rather than outright exclusion. The general public commented that the use of deciduous species needs research.

I have considered carefully the potential role of deciduous species in forest management in the TSA, both with respect to their ability to contribute a sustainable deciduous harvest in the TSA and in context of biodiversity objectives that may be consequential to the proposed acceleration of the pine harvest to control the MPB.

In general, I consider that in view of the very low performance in harvesting under the present partition, current practice is reflected adequately by the exclusions applied in modelling the minor components in both deciduous and coniferous stands, and better than by applying a deferral period, which would in any case be speculative. In particular, if predominantly deciduous stands are not being harvested, their minor coniferous component should not be used to artificially inflate available softwood volumes. On the other hand, while the base case showed shortfalls in the deciduous harvest level after 130 years, I believe it is reasonable to assume that at least some of the deciduous stands excluded for low merchantability could in practice be accessed operationally if necessary to complement the supply from eligible stands and offset the projected future shortfalls. Therefore, in the absence of other considerations, I believe it would be possible to find sufficient deciduous volume over time to maintain the partition indefinitely at its current level.

However, there are other, very serious considerations affecting the legitimacy of this conclusion that result from a potentially greatly accelerated coniferous harvest to manage the current epidemic MPB infestation. The base case and other analyses discussed below under 'Epidemic mountain pine beetle infestation', show harvest projections that can be attained while meeting all biodiversity requirements under the Code and under the Cariboo-Chilcotin Land Use Plan (CCLUP). Nonetheless, it is inevitable that the degree of management flexibility available to meet these requirements will be reduced to some degree under an accelerated harvest rate. For instance, I consider it probable that in at least some cases the extensive activity of the MPB may preclude achievement of district staff's current objective of selecting a standard mix of coniferous and deciduous species, rather than deciduous alone, to fulfil the requirements for wildlife tree patches. This could result in the need for assurance that a greater number of deciduous trees will remain on the landscape for wildlife tree purposes. It is also likely that if the coniferous harvest is accelerated significantly, the objective of eliminating the infestation may, in at least some—and given the current rate of spread, likely very many—cases, override cutblock adjacency and green-up requirements. In this situation again the deciduous component may be called on to an extent greater than contemplated, to help meet the range of objectives addressed by adjacency requirements.

It is clear that deciduous species—which are not targeted by the MPB, but which are in many cases interspersed with pine in areas of severest attack—are potentially capable of making an important contribution to the provision of forest cover for biodiversity purposes following the required harvest of large areas of infested pine particularly in mixed stands. Therefore, while I am mindful that one company is proposing to build a facility to utilize birch wood, in view of the currently very small harvest of deciduous species in the TSA I have decided to lower the allowable harvest attributable to deciduous species by an amount that will not limit the current and expected degree of utilization of these species, but could potentially provide invaluable management flexibility in meeting biodiversity objectives. Accordingly, as discussed in 'Reasons for Decision', I have decided to establish at this time an allowable harvest level of 20 000 cubic metres attributable to deciduous species.

Some deciduous stands in the TSA are converting by natural succession to coniferous stands. To a currently unquantifiable extent, this implies overestimation in the deciduous

component, and underestimation in the coniferous component, of the timber supply, and I have noted this in 'Reasons for Decision'.

- roads, trails and landings

During timber supply analysis, a percentage of the productive forest otherwise considered available for harvesting is excluded to account for the construction of logging roads, trails and landings.

Records from 1996 onward from the Ministry of Forests' Integrated Silviculture Information System (ISIS) and its Major Licensee Silviculture Information System (MLSIS) indicate that over the long term, 4.4 percent of the timber harvesting land base will be occupied by roads, trails and landings. In the previous timber supply analysis, it was assumed that 2.5 percent of the timber harvesting land base was occupied by existing roads, trails and landings. For the current analysis, a 4.4-percent reduction was applied to stands with a logging history. To account for the remaining existing roads, trails and landings, a 2.5 percent reduction was applied to all stands. As a result, 30 454 hectares of productive forest—2.3 percent of the Crown forest land—were deducted to account for existing roads, trails and landings.

To account for future roads, from all stands without a harvesting history, 1.9 percent of the timber harvesting land base was removed after the first harvest. In total, a deduction of 14 651 hectares was made in respect of future roads. Following the deduction of 14 651 hectares for future roads, the long-term timber harvesting land base amounts to 996 237 hectares. (Please note the typographical error in the former figure of 996 327 hectares published in the analysis report.)

I am satisfied that appropriate procedures have been followed in accounting in the analysis for the effects of roads, trails and landings on the size of the timber harvesting land base.

- protected areas

All formally designated protected areas were excluded in deriving the timber harvesting land base used in the timber supply analysis.

However, the province's Protected Areas Strategy has two goals. The first is to protect viable, representative examples of natural diversity in the province, representative of the major terrestrial, marine and freshwater ecosystems, the characteristic habitats, hydrology and landforms, and the characteristic backcountry recreational and cultural heritage values of each ecosection. The second goal is to protect the special natural, cultural heritage and recreational features of the province, including rare and endangered species and critical habitats, outstanding or unique botanical, zoological, geological and paleontological features, outstanding or fragile cultural heritage features, and outstanding outdoor recreational features such as trails.

The Cariboo-Chilcotin Land Use Plan (CCLUP), which includes the entire Quesnel TSA, provides for 'Goal 2' protected areas totalling up to 0.25 percent of the area covered by the plan. No logging currently takes place in areas identified as candidates for 'Goal 2' areas, except where necessitated by beetle activity. However, these candidate areas have not yet been established by government through Order in Council, and may be relocated through

sub-regional planning processes. It is possible that some or all of the Goal 2 areas may displace portions of the timber harvesting land base.

In the analysis, no accounting was made for any loss of harvestable land base associated with 'Goal 2' protected areas. Because these areas have not yet been finally located or designated by government, in accordance with the guiding principles set out earlier in this document, and with similar decisions taken earlier on other management units and upheld in provincial courts, I will not attempt to speculate on how government may decide on these areas, or on the possible implications their designation could have for the timber supply. I note that in a sensitivity analysis in which the size of the timber harvesting land base was reduced by the much larger quotient of 10 percent, the elevated 'worst-case' harvest level discussed below in 'Epidemic mountain pine beetle infestation' could still be met for ten years on acceptance of a slightly reduced mid-term level. For the purposes of this AAC determination I therefore accept the inclusion in the timber harvesting land base of these uncertainly located and as-yet-undesignated 'Goal 2' protected areas. When these areas have been formally designated with definite locations, any timber supply implications can be analysed and accounted for in a future AAC determination.

- woodlot licences

The *Forest Act* requires AACs for TSAs to be determined in exclusion of timber supply contributions from issued woodlot licences. When a woodlot licence is initially issued, the associated harvest level is allocated from an appropriate apportionment under the AAC for the TSA. The woodlot harvest level remains as an apportioned part of the AAC for the TSA until the next AAC determination for the TSA, when the TSA land base is reduced by the area of Crown land in all the woodlot licences issued since the previous determination. At this time the total volume in issued woodlot licences is excluded from contributing to the AAC for the TSA.

In the Quesnel TSA, a total of 34 500 cubic metres were issued as woodlot licences up to1996, and a further 38 370 cubic metres were issued between 1996 and 2001. In adjusting the timber harvesting land base to reflect the exclusion and the separate administration of these woodlot licence volumes from the AAC for the TSA, ownership codes for 6825 hectares were incorrectly assigned, resulting in an underestimation by that amount in the timber harvesting land base used in the analysis. In my determination, as noted in 'Reasons for Decision', I have accounted for the re-inclusion of these improperly excluded hectares as a slight underestimation in the projected timber supply. As also noted in 'Reasons for Decision', I have adjusted the final AAC for the TSA to reflect the total issued woodlot licence volume of 72 870 cubic metres.

- riparian land base exclusions

Riparian reserves totalling 30 041 hectares were identified in the TSA, requiring a reduction (net of overlaps for other objectives) of 26 602 hectares of productive forest in deriving the timber harvesting land base. Similarly, a further reduction of 15 787 hectares was made in respect of the only partial availability of timber for harvest in 17 458 hectares of riparian management zones. This is discussed further under - *riparian habitats*.

Existing forest inventory

- status of current inventory

The Quesnel TSA encompasses 188 whole or partial mapsheets, and all significant harvesting and other disturbances from 1995 to 1998 were incorporated into the file used for the timber supply analysis. Forest stand characteristics, and growth and yield were projected to December 31 1998. The inventory data file included a reclassification of the forest cover across the entire TSA, completed to pre-Vegetation–Resource-Inventory standards between 1988 and 1997. Further, stocking class was recalculated for each stand in the productive forest. The file was compiled by staff of the Cariboo Forest Region early in 1999, and included various theme layers obtained from the Ministry of Environment, Lands and Parks (MELP).

In June of 1999, the Ministry of Forests' Resources Inventory Branch completed an inventory audit for this TSA. The audit results for the immature component of the inventory suggested an acceptable level of accuracy for site index assignment in young stands, and I have discussed this below in – *estimates for site productivity*. For the mature component, the audit results suggested that the timber volumes in existing mature stands may be overestimated by approximately 11 percent, as discussed under *volume estimates for existing natural stands*. With the qualifications noted in these sections, I am satisfied that the existing inventory on which the timber supply analysis was based is of a standard comparable to forest inventory files used for management units in the remainder of the province, is reliable for strategic planning purposes, represents the best available information, and is therefore adequate for use in this determination.

- age-class distribution and species composition

I have reviewed figures 4 and 5 on page 10 of the timber supply analysis, and I am aware that a large proportion of the timber harvesting land base in the Quesnel TSA supports forest stands aged 80 years and higher. Because the majority of these stands are pine forests, much of the harvestable timber in the TSA is clearly susceptible—if exposed—to attack by MPB, as discussed below in 'Epidemic mountain pine beetle infestation', under section 8(8)(e) of the *Forest Act*, *abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area*.

In my determination I have been mindful of the age distribution and species composition of the forest stands both in and outside the timber harvesting land base. In view of the current threatened widespread attack by the beetle and of the prevalence of its preferred host timber type, I am satisfied that forest management activities in the TSA must be planned in coordination with the currently evolving status of the MPB population.

From my understanding of timber supply analysis and my discussions with the analyst, I am also satisfied that the current and predicted age-class composition in the Quesnel TSA has been adequately incorporated and accounted for in the timber supply projections described in the analysis report.

- volume estimates for existing natural stands

The Variable Density Yield Prediction (VDYP) model version 6.4a, developed and supported by the Ministry of Forests' Resources Inventory Branch, was used to estimate

timber volumes for existing natural stands for the 2001 timber supply analysis for the Quesnel TSA.

In June 1999, the Ministry of Forests' Resources Inventory Branch completed an inventory audit for this TSA. The audit showed a statistically significant 13-percent difference between the estimated mean mature volume obtained from the inventory and that obtained from the audit. Consequently the VDYP model was used to generate volume estimates from the forest cover attributes obtained from ground samples, for comparison with those generated from the attributes in the inventory file. The results suggested that the timber volumes in the existing-mature-stands component of the inventory may be overestimated by approximately 11 percent.

A sensitivity analysis was carried out to assess the risk to the projected timber supply if existing mature stand volumes are overestimated by 10 percent. This condition was applied to a projection in which the initial harvest level was set at one million cubic metres higher than the base case initial harvest level (see below, 'Alternative harvest flows', and 'Epidemic mountain pine beetle infestation', the 'worst case' forecast). This sensitivity analysis showed that with the mature volume estimates reduced by 10 percent, the higher harvest levels could still be maintained as projected in the 'worst case' forecast for three decades, followed by a decline to a medium-term harvest level of 1 960 000 cubic metres per year, 120 000 cubic metres per year below the 'worst case' mid term level of 2 080 000 cubic metres per year, which was held until the rise to the long-term level in decade 14.[2]

Post audit analysis work identified the Narcosli (east and west) as the main source of the problem. A breakdown of samples by Biogeoclimatic Ecosystem Classification (BEC) zone showed that the Sub-Boreal Pine-Spruce (SBPS) zone stands out with an inventory overestimate of approx 25 percent. Where the SBPS and the Narcosli overlap the overestimate approached 28 percent. In the sensitivity analysis, volumes were adjusted by 10 percent across all polygons, not in consistency with these area variations. Nonetheless, considered separately, this factor indicates an overestimation in the timber supply resulting in a reduction expected to be in the order of magnitude of approximately 120 000 cubic metres per year in the projected mid-term harvest level, and I have taken this into account in my determination as discussed in 'Reasons for Decision'.

Expected rate of growth

- estimates for site productivity

Inventory data includes estimates of site productivity for each forest stand, expressed in terms of a site index. The site index is based on the height of the stand as a function of its age, and is typically expressed in metres reached by the age of 50 years. The productivity of a site largely determines how quickly trees grow. This in turn affects the time seedlings will take to reach green-up conditions, the volume of timber that can be produced in regenerated stands, and the ages at which a stand will satisfy mature forest cover requirements and reach a merchantable size.

In general, in British Columbia, site indices determined from young and old stands may not accurately reflect potential site productivity. In young stands, growth often depends as

[2] Please note slight changes from figures published in the analysis report.

much on recent weather, stocking density and competition from other vegetation, as it does on site quality. In old stands, which have not been subject to management of stocking density, the trees used to measure site productivity may have grown under intense competition or may have been damaged, and therefore may not reflect the true growing potential of the site. This has been verified in several areas of the province where studies—such as the Old-Growth Site Index (OGSI) 'paired plot' project and the 'veteran' study—as well as results from using the Site Index Biogeoclimatic Ecosystem Classification System (SIBEC) suggest that actual site indices may be higher than those indicated by existing data from mature forests. In recent years it has been concluded from such studies that site productivity has generally been underestimated by the inventory file data; managed stands tend to grow faster than projected by inventory-based site index estimates from old-growth stands.

The site index values assumed in the base case analysis for the Quesnel TSA were taken directly from the forest inventory files as there are no local data for adjusting site indices. Staff from BCFS and major licensees are currently reviewing the possible need for adjustments to or re-assignment of site index values, based on OGSI and SIBEC studies in the region. Results are not yet available for the TSA, but should be ready for use in the next timber supply review. In public input, licensees have referred to site index adjustments as potentially contributing to an enhanced timber supply under particular circumstances, as indicated in the *Timber Investments Strategy Committee Report* noted earlier.

Subsequent to the base case analysis, a generalized (at the variant level of resolution) SIBEC sensitivity analysis was carried out to examine the effect of re-assigning site indices to appropriate stands, using 1:250 000 Biogeoclimatic Zone maps and zonal site series information. New site index values were assigned to stands of 40 years and younger, to reflect their managed condition, and to sites currently occupied by stands of 141 years and older—after harvest, to reflect their eventual regeneration under managed conditions. No changes in site index were applied to unmanaged thrifty stands aged 41 to 140 years as site index values are generally accurate in these stands. The average site index of stands assigned a new productivity estimate increased by 2.7 metres (with a resulting average increase of 1.04 metres for the whole TSA). Other timber supply analysis inputs that are affected by changes in site productivity—i.e. managed stand volume estimates, green-up ages and minimum harvestable ages—were then recalculated based on the adjusted average site productivity. When all these changes were applied to the 'worst-case' timber supply projection, after harvesting at one-million cubic metres higher than the current AAC for 10 years, the harvest level declined to 2 340 000 cubic metres per year (the current AAC). This level was then maintained until year 260, followed by an increase to a steady long term level of 2 460 000 cubic metres per year. While local data was not used, the results, when considered separately, do indicate the possibility of a more favourable timber supply for the entire harvest forecast.

As noted earlier, the results of the recent BCFS inventory audit for the immature component of the inventory (defined as stands greater than free growing and less than 60 years of age) suggested 'an acceptable level of accuracy for site index assignments in currently regenerated young stands in the TSA.' However, for two reasons, this result is not inconsistent with the SIBEC conclusion of an underestimation in site productivity. First, the audit is designed to assess the accuracy of the height and age attributes and the

derived site index on the current inventory file, not the potential productivity per se. Thus the file, in general, may accurately report the stand characteristics in a suppressed, repressed or damaged stand without directly identifying the true growing potential of the site. The SIBEC process, in contrast, is intended to directly reflect the potential productivity of the site. Thus the inventory attributes and derived site index may be audited as generally accurate, while the potential site productivity itself remains underestimated. Second, further review of the audit data suggests that the 11 youngest audit plots in stands less than 46 years—admittedly a small sample for the TSA—suggest an underestimation in site index of approximately 3.5 metres. On the basis of these considerations I have assessed the applicability of the results of the SIBEC sensitivity analysis in this determination as follows.

While I am aware of the absence of local site productivity studies, I must acknowledge the numerous biological factors that may lead to an underestimation of site productivity when using the attributes of existing stands to derive site index. Further, while a generalized site index assignment was used, I am advised that that the SIBEC site index estimates were derived using information from sites with similar characteristics (soil moisture and nutrient regime) and areas with similar climate to those existing in the Quesnel TSA. I therefore find it reasonable to conclude that, based on the higher site productivity suggested by SIBEC studies, the analysis using site indices directly from the inventory file underestimates the timber supply to some degree. While the magnitude of the impact is uncertain, I am satisfied that the general trend of higher medium-term timber supply shown in the SIBEC sensitivity analysis is a reasonable expectation. In my determination, I have taken this into account as discussed in 'Reasons for Decision'.

- volume estimates for managed regenerated stands.

In the timber supply analysis all forest stands regenerated since 1969 and 75 percent of the stands regenerated between 1959 and 1968 were assumed to be managed. The timber volumes expected to be present in these and future regenerated stands were estimated with the use of the growth and yield model 'Table Interpolation Program for Stand Yields' (TIPSY, version 3.0i). In this process, TIPSY projections are initially based on ideal conditions, assuming full site occupancy and the absence of pests, diseases and significant brush competition in the stand. However, certain operational conditions, such as a less-than-ideal distribution of trees, the presence of small non-productive areas, endemic pests and diseases, or age dependent factors such as decay, waste and breakage may cause yields to be reduced over time. Two operational adjustment factors (OAFs) are therefore applied to yields generated using TIPSY to account for losses of timber volume resulting from these operational conditions. OAF 1 is designed to account for factors affecting the yield curve across all ages, such as small stand openings, and OAF 2, for factors whose impacts tend to increase over time and whose influence on a stand may be reduced through management practices—such as decay, waste and breakage.

In the Quesnel analysis, for OAF 1 the standard provincial reduction of 15 percent was applied, and for OAF 2, a value increasing from zero and passing through the standard value of 5 percent at the point where forest stands reached an age of 100 years.

District staff note that an estimated 100 percent of spruce and 10 percent of lodgepole pine seedlings will come from select seed. In this respect, a genetic gain of 13.9 percent was incorporated in the analysis for spruce volumes, but the current prediction of a 0.2 percent

volume increase for pine was considered too small an adjustment to be reliable and was not applied. In the analysis it was assumed that all regenerated stands aged from one to 30 years are managed, and that 75 percent of stands aged 31 to 40 have experienced some form of management intervention, mainly from spacing. District staff consider this an accurate reflection of current management.

On the basis of the foregoing information I am satisfied that, with the exception of the 0.2 percent underestimation in pine volumes in respect of the use of select seed, which I have noted in 'Reasons for Decision', the methodology used in the analysis for estimating timber volumes in managed regenerated stands adequately reflects current practice and that, on this account, the resulting timber supply projections are suitable for consideration in this determination.

- minimum harvestable ages

A minimum harvestable age is an estimate of the earliest age at which a forest stand has grown or will grow to a harvestable condition. The minimum harvestable age assumption mainly affects when second growth will be available for harvest. This in turn affects how quickly existing stands may be harvested such that a stable flow of harvestable timber may be maintained.

In preparation for the Quesnel TSA timber supply analysis, forest district staff reviewed cruise information for 16 110 hectares, to determine the minimum volume at which sawlog stands were harvested. Based on licensee performance, the minimum volume per hectare considered harvestable, provided utilization criteria are met, is 150 cubic metres per hectare, for both sawlog and problem forest type analysis units. This minimum volume of 150 cubic metres per hectare was used to determine the minimum harvestable ages. The so-derived minimum harvestable ages used in the analysis ranged from 43 years for managed pine stands on sites of good productivity (which were actually modelled as 53 years), to 140 and 160 years. (Partial and selection harvesting systems are discussed under wildlife habitat sections, below.)

In the analysis, it was assumed that forest stands would be harvested in a sequence termed 'relative oldest first', and in many cases stands were not assumed to be harvested until beyond minimum harvestable age due to management objectives for other resource values.

District staff advise me that the minimum harvestable ages assumed in the analysis are reasonable given current utilization and minimum operable volumes. From reviewing the table of ages assigned to the various analysis units, I am satisfied that for the key units at least, the minimum harvestable ages represented in the analysis are indicative of reasonable assumptions of growth and yield, and are acceptable for use in the timber supply projections I have considered in this determination.

(ii) the expected time that it will take the forest to become re-established on the area following denudation:

Regeneration delay

Regeneration delay is the time that elapses between when an area is harvested and when it becomes occupied by a specified minimum number of acceptable, well-spaced seedlings.

For this determination I was presented with and have considered a table showing for each analysis unit: the expected regeneration delay; the regeneration methods and the proportions of each to be used; the expected species and percentage composition (from analysis of historic data records by site class); and the expected stand densities (average stems per hectare for all sites by analysis unit) initially and when thinned. District staff note that the density targets are achieved on most stands, or are spaced as necessary.

In the timber supply analysis, prompt reforestation was assumed with regeneration delays ranging from two years for planted stands to 7 years for naturally regenerated stands. The actual regeneration delays used in the timber supply model were proportional to the percent component of planted and natural area.

In public input, licensees questioned a regeneration delay of 7 years, but I am advised by district staff that the assumptions used are based on historic records and represent current and expected performance. From my review of the information presented, in my experience, the assumed regeneration delays are within a reasonable range. I note that the majority of the planting stock used in the TSA is one year old and that this has been taken into account in the assumed regeneration periods.

I am therefore satisfied that the regeneration assumptions used in the analysis, based on historic data, are reliable for use in this determination—with one important and specific exception in the case of forests regenerating on sites still occupied after several years by timber killed by beetles and remaining unharvested, as discussed in the next section.

Impediments to prompt regeneration

- implications from mountain pine beetle

Despite the validity of the regeneration assumptions as described in the previous section under normal conditions, the current MPB infestation has the potential to seriously affect the regeneration delay period in some areas. In the sections 'Alternative harvest flows' and 'Epidemic mountain pine beetle infestation' below, a timber harvest forecast including an immediate increase of one million cubic metres is presented—the so-called 'worst case' scenario. In this forecast, it is assumed that, if trees remain unharvested five years after attack by beetles, they will have lost 50 percent of their merchantable volume; for stands where this results in a minimum operable volume below 150 cubic metres per hectare, all volume is considered lost and a new stand would be required to regenerate and develop into merchantable timber. If current rates of spread of the MPB continue, it is likely that significant amounts of killed but unharvested mature timber will remain on the landscape, in which case the regeneration of a new forest may be substantially impeded.

To investigate the implications of this condition for the timber supply in the TSA, a sensitivity analysis was performed on the 'worst case' projection, in which it was assumed for areas supporting timber killed by beetles and still standing unsalvaged after five years, that a new forest would not regenerate until another ten years had passed, for a total of fifteen years from the year in which the timber had been killed. In the analysis it was assumed that this would be a one-time delay and that all such stands would regenerate as unmanaged stands, that is, with growth and yield appropriately modelled by VDYP rather than TIPSY. The resulting projection showed that without affecting short-term harvest

levels, a reduction in the order of 50 000 cubic metres annually in the mid-term harvest level could be expected.

While this specific assumption of a 15-year delay is not indicative of the range of varied responses that could be expected in different areas of the TSA (for instance, spruce understories exist in some areas), in my judgement this assumption does provide a more realistic assessment of the regeneration capabilities under these conditions than the assumption in the 'worst' case projection, which is that such stands would begin to regenerate to VDYP growth and yield predictions five years after being killed. My judgement in this is based in part on the likelihood that, considering the large areas already infested by the MPB, and the current rate of spread, significant areas of unsalvaged timber will remain on the landscape for considerable periods of time, even with a substantially accelerated harvest. I have discussed this problem further below, under 'Epidemic mountain pine beetle infestation'.

In consideration of this potentially widespread problem, I have taken into account in my determination the moderate likelihood of a reduction of up to 50 000 cubic metres per year in the harvest level projected for the mid term in the 'worst-case' projection, as discussed in 'Reasons for Decision'.

- brush competition

In public input, First Nations raised a concern about the impact of herbicides on biodiversity. I understand from the district manager that the management of brush species on harvested sites is a concern in the Quesnel TSA. District staff use a variety of tools to reduce brush competition on reforested sites. The need for herbicide treatments is reduced through prompt reforestation, and options such as manual brush control and the use of sheep to reduce brush are used as appropriate. However, on some sites herbicides are needed to reduce brush. The district staff use herbicides only in accordance with a Pest Management Plan approved by the Ministry of Environment, Lands and Parks. These approvals, which require prior consultation with First nations and other stakeholders, are required to ensure pesticide use in the province is carried out with minimal risk to the environment and human health. By virtue of this approval, I am satisfied that the use of herbicides by district staff in brush control is within acceptable limits of risk.

Not-satisfactorily-restocked areas

Not-satisfactorily-restocked (NSR) areas are those where timber has been removed, either by harvesting or by natural causes, and a stand of suitable forest species and stocking has yet to be established. Areas where the standard regeneration delay has not yet elapsed after harvesting are considered 'current' NSR. Where a suitable stand has not been regenerated and the site was harvested prior to 1987, the classification is 'backlog' NSR.

The integrated silviculture information system (ISIS) and the major licensee silviculture information system (MLSIS) summaries identify 18 328 hectares of 'current' NSR land, and 4698.4 hectares of 'backlog' NSR land in the Quesnel TSA.

Inventory records currently show a total NSR area (current and backlog) of 31 917.1 hectares. The difference of 8890.7 hectares between the silviculture and the inventory records is considered to reflect a delay in updating the inventory file. Following a careful

study of the records, this area is now assumed to be stocked and in the analysis was not excluded in deriving the timber harvesting land base.

In the analysis, all 'current' NSR was assumed to regenerate within the identified regeneration delays. It was also assumed that the overall distribution of harvest within analysis units has not changed significantly over the last 20 years, such that the NSR may therefore be assumed to be restocked in proportion to the current area of each analysis unit which supports stands younger than 20 years old. Further, all backlog NSR is assumed to be restocked within 10 years, with 75 percent being restocked in the first 5 years and the remaining 25 percent in the next 5 years. All NSR areas in which harvesting has taken place are included in the timber harvesting land base.

From discussions with district staff I note that there is some uncertainty about the condition of the 4700 hectares of backlog NSR, and that the economic feasibility of treating all of these hectares is currently under study. These hectares do represent productive sites, and while treatment options for them may be limited such that the trees on them may not be spaced appropriately to merit the estimation of growth and yield by managed stand yield tables, it is reasonable to expect some level of contribution to the harvest. In view of the uncertainty I recommend that staff develop further information during the effective period of this AAC so that the contribution of these areas may be reassessed for the next analysis. For the present determination I am prepared to accept the restocking assumptions as applied in the analysis, on the basis that the level of uncertainty in this factor is not sufficient to pose any appreciable risk to the projected timber supply.

(iii) silvicultural treatments to be applied to the area:

Silvicultural systems

- clearcut harvesting:

Due to the species composition of the forests in the Quesnel TSA, even-aged silvicultural systems are predominant. With the exception of the caribou areas and mule deer winter range, discussed below, under normal conditions all harvesting in the TSA is expected to be by clearcutting. Clearcutting of infected stands is also the primary control treatment for MPB where lodgepole pine is the primary species.

- selection harvesting and partial cutting

Uneven aged group selection harvesting is practised in stands dominated by fir in mule deer winter range, and partial cutting is practised in the 'Caribou-modified-harvest areas', as specified in the Cariboo-Chilcotin Land Use Plan (CCLUP) (see below, *wildlife habitat: -mule deer winter range* and – *caribou habitat*).

Partial cutting is also used to address MPB infestations in stands where pine is not a primary species and where the level of infection warrants removal of infected and susceptible trees. This 'snip-and-skid' practice was not modelled in the analysis due to the impossibility of identifying in advance the stands in which this would occur.

- species conversion after harvesting

In the previous timber supply review, uncertainty was identified in the extent to which forest stands were converted after harvesting to other—in some cases faster-growing—species, and in the resulting implications for site indices and for timber supply projections. A subsequent study initiated by district staff to determine the extent of species conversion after harvesting was inconclusive due to data limitations. In the opinion of district staff, however, due to mixed species planting and natural ingress, in general most stands tend to regenerate to the species present prior to disturbance. For the current determination, I am therefore satisfied that any implications for inaccuracy in the timber supply projection due to species conversion are likely to be small or insignificant. In wet-belt and transition areas, some licensees are now using a shelterwood system to help the regeneration of Douglas-fir, both within areas of mule-deer winter range, and elsewhere to reduce the amount of non beetle-attacked wood being processed from infested stands of predominantly Douglas-fir. Any implications for timber supply from such alternative systems should be reflected in the next timber supply analysis.

In the timber supply analysis the majority of the harvesting was assumed to be by clearcutting, with the appropriate volume constraints applied as indicated in the mule deer and caribou areas. Since no significant implications from species conversion or from other silvicultural systems have been identified, I am satisfied that for the purposes of this determination the timber supply analysis projections adequately reflect the silvicultural systems currently in use in the TSA.

Incremental silviculture

In general, incremental silviculture includes activities beyond those required to establish free-growing forest stands through basic silviculture. Such activities include commercial thinning, juvenile spacing (beyond that required to meet basic silviculture obligations), pruning, and fertilizing.

Commercial thinning has been tried in the TSA, but the economics are not advantageous. Spacing was being carried out five years ago to 1400 stems per hectare, but now 2000 to 2500 stems are more common. Reduced stem numbers have led to problems with tree 'crowns' and with wood quality, and no significant reliance on commercial thinning is anticipated in the near term.

With respect to genetic gains, as noted above in - *volume estimates for regenerated managed stands*, an estimated 100 percent of spruce and 10 percent of lodgepole pine seedlings used in the TSA will come from select seed, and consequently a genetic gain of 13.9 percent was incorporated in the analysis for spruce volumes, but the current prediction of a 0.2 percent volume increase for pine was considered too small an adjustment to be reliable and was not applied. I have addressed this in 'Reasons for Decision'.

No other specific incremental silviculture activities in the TSA were identified. Therefore, since the genetic volume gains have been adequately accounted for, I am satisfied that the implications for timber supply from incremental silviculture as currently practiced in the Quesnel TSA are appropriately represented in the analysis.

(iv) the standard of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area:

Utilization standards

Utilization standards define the species, dimensions and quality of trees that must be harvested and removed from an area during harvesting operations. The standards applied in the Quesnel TSA areas are shown in the following table:

Analysis unit	Utilization		
	Minimum diameter at breast height (centimetres)	Maximum stump height (centimetres)	Minimum top diameter inside bark (centimetres)
Sawlogs:			
Pine	12.5	30	10
Other species	17.5	30	10
Problem Forest Types:			
Pine species	7.5	20	5 - 7
Other species	12.5	20	7.0

BCFS staff note that these standards were reflected in the analysis in all respects except that the VDYP model used to generate volume projections for this timber supply analysis is limited to a 10-centimetre minimum top diameter inside bark, while pine species are in fact utilized to a 5-to-7-centimetre top. This discrepancy was raised by licensees in public input. Evaluations of the differences in volume estimates for *coastal* species resulting from this limitation in the VDYP system have shown the difference in merchantable volume to be on average less than 2 percent. The merchantable volume differential in the Quesnel TSA may be higher than this, as lodgepole pine tree stems show comparatively little taper. I am advised, however, that any consequent additional volume gained by licensees on replaceable forest licences for sawlogs is not charged to cut control or to the licence AAC. This difference does not affect the *area* projected to be logged, but only the volume per hectare expected to be realized from the area logged. Since any extra volume thereby achieved that remains unaccounted-for over and above the projected available volumes is not charged to sawlog licence AACs, then although some discrepancy must be acknowledged, I am satisfied that licensees are at no disadvantage in this respect and that the implications for the projected supply are relatively small. I therefore accept that the utilization assumptions used in the timber supply analysis are adequate for use in this determination.

Decay, waste and breakage

The VDYP model used to project volumes for natural stands incorporates estimates of the volumes of wood lost to decay, waste and breakage. Decay losses are built into the

volume estimates, while standard waste and breakage factors are applied to the analysis in the development of VDYP yield curves. These estimates of losses have been developed for different areas of the province based on field samples. For regenerated stands, as previously noted in - *volume estimates for regenerated managed stands*, the TIPSY model incorporates an operational adjustment factor (OAF2) to account for anticipated decay, waste and breakage, and the value applied for OAF 2 in the Quesnel analyses increased from zero to pass through 5 percent at the point where forest stands reached an age of 100 years. From this review I am satisfied that adequate care has been taken in the analysis to account for the projected timber supply implications likely to arise from standard expectations for decay, waste and breakage.

(v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production:

Resource management objectives

The Ministry of Forests is required under the *Ministry of Forests Act* to manage, protect and conserve the forest and range resources of the Crown and to plan the use of these resources so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated. Accordingly, the extent to which integrated resource management (IRM) objectives for various forest resources and values affect timber supply must be considered in AAC determinations.

- cutblock adjacency, forest cover and green-up

To manage for resources such as water quality, wildlife and aesthetics, and to avoid concentrating harvesting-related disturbance in particular areas, operational practices limit the size and shape of cutblocks and maximum disturbances (areas covered by stands of less than a specified height), and prescribe minimum green-up heights required for regeneration on harvested areas before adjacent areas may be harvested. Green-up requirements ensure maintenance of water quality, wildlife habitat, soil stability and aesthetics. Adjacency, green-up and forest cover objectives guide harvesting practices to provide for a distribution of harvested areas and retained forest cover in a variety of age classes across the landscape.

In the timber supply analysis for the Quesnel TSA, forest cover requirements were applied specifying maximum or minimum permissible percentages of forest cover for various seral stages to model management for biodiversity, wildlife habitats, scenic values, and cutblock adjacency. Under the time constraints imposed on the analysis by the urgency of the need to deal with the MPB infestation, the cover constraints were developed using times to green-up calculated from the 'Batch site tools Version 3.2i' equations—rather than the localized ages from the recent publication *Age to Green Up Height Using Regeneration Survey Data,* by BCFS, Aug. 2000—with the ages to green-up height given by the area-weighted average for each landscape unit.

In the analysis, for the general resources management (GRM) zone (the zone least constraining on timber supply), which covers 87 percent of the timber harvesting land base, a constraint was applied requiring at least 65 percent of the forest cover to be at least 3 metres tall at all times. Other specific cover constraints were applied to reflect particular objectives for moose habitat, caribou habitat, mule deer winter range, and scenic values, as

detailed in the appropriate sections below. To ensure adequate representation of requirements for landscape-level biodiversity, the modelling assumptions in the analysis were consistent with the Biodiversity Conservation Strategy of the CCLUP.

In public input, licensees were concerned that contributions from forests outside the timber harvesting land base toward the attainment of forest cover objectives should be recognized. In fact this is the case in all BCFS analyses; allowable contributions from the entire land base are assumed in accordance with the provisions of the Forest Practices Code.

In considering the appropriateness of the forest cover assumptions in the analysis generally, I note that the constraints applied for multiple-use areas, scenic areas and caribou habitat were consistent with the CCLUP and, subject to qualifications expressed in the following paragraph, are therefore suitable for use in this determination. If more detail is provided within the overall CCLUP framework in the future, under sub-regional plans, this can be taken into account in a subsequent determination.

The use of the 'Batch Site Tools' is likely to have resulted in slightly longer times to green up than would be indicated by the August 2000 publication, with a corresponding possible small underestimation in the timber supply. Any such small difference is likely to be completely overtaken, however, by the probable waiving of the adjacency guidelines in many areas in the TSA in response to the urgency to remove not only all trees infested with MPB, but potentially in some cases also a number of surrounding unaffected trees in order to access trees infested by the MPB.

The adjacency constraints applied in the 'worst-case' timber supply projection (see 'Alternative harvest flows' and 'Epidemic mountain pine beetle infestation') were identical to those applied in the base case analysis. Under these constraints the initial harvest level could still be held for ten years at one million (or more) cubic-metres above the base-case initial level, but only with a reduced mid-term level. However, removing the adjacency restrictions altogether in the GRM zone under such an accelerated harvest could lead to regeneration of larger areas of unfragmented forest than projected. This would lead, upon maturity of these large areas of contiguous forest, to greater management flexibility in locating cutblocks in the mid term than was previously expected. Since the mid-term timber supply projected in both the base case and 'worst-case' analyses was limited by management constraints, this additional flexibility would provide a corresponding increase in the availability of the timber supporting the projected mid-term harvest level. Conversely, planning problems could arise after the current harvest until the regenerated stands mature again, but these will be lessened by the predominance of forest cover currently above the minimum harvestable age.

Under the time constraints for the current analysis, no sensitivity analysis was possible to quantify this effect. However, I am satisfied that the waiving of adjacency requirements in the short term for MPB management will lead in this way to a currently unquantifiable increase in the mid-term supply over that projected in the 'worst-case' forecast. I have taken this into account in my determination as discussed in 'Reasons for Decision'.

- visually sensitive areas

Careful management of scenic areas visible from communities, public use areas and travel corridors is an important forest management objective. The Forest Practices Code enables the management of visual resources by providing for scenic areas to be identified and made

known, and by providing for the establishment of visual quality objectives (VQOs). To achieve this, visual landscape inventories are carried out to identify, classify and record visually sensitive areas. On completion of such an inventory, a specialist may derive recommended visual quality classes (RVQCs, i.e.: 'Preservation'; 'Retention'; 'Partial retention'; 'Modification' or 'Maximum Modification' to identify levels of alteration that would be appropriate for particular areas. The Code requires these areas to be identified, by the district manager or in a higher level plan, and to be made known to licensees. When this has been done and an RVQC has become current practice, it may be incorporated into a timber supply analysis, preferably as a VQO established by the district manager or contained in a higher level plan. Established VQOs reflect the desired level of visual quality, based on the physical characteristics and social concern for an area, and seek to balance the perceptions and needs of people with the social and economic needs of the province. To achieve VQOs, constraints are placed on timber harvesting, road building and other forest practices.

Visually sensitive scenic areas that have been made known in the Quesnel TSA represent 3.5 percent of the total TSA land base. Objectives have been specified for each sensitive area. To reflect the requirement that visible evidence of harvesting be kept within the specified limits, depending on the visual sensitivity of the area and its objective, at least 85 percent ('partial retention' VQO) to 95 percent ('retention' VQO) of the forested area (including both the timber harvesting land base and non-contributing forest areas) was required to be at least three metres tall at all times.

The CCLUP includes broad requirements implying that eventually more extensive visually sensitive areas may need to be accounted for, but also sets limits on the permissible impact these may have on timber harvest levels. Any new developments in this regard can be reflected in future analyses. The current timber supply analysis accounts for all areas now made known to licensees, and reflects all the management constraints to which licensees are presently required to adhere. I therefore consider that for the purposes of this determination the constraints on timber supply from areas currently expected to be managed for visual sensitivity have been modelled appropriately in the analysis.

- cultural heritage resources

As noted earlier, in the 'Description of the TSA', the Kluskus Band, the Lhtako-Dene First Nation (Red Bluff Band), Alexandria Band, and the Nazko Band, as well as ten other First Nations communities located outside the TSA, have all asserted traditional territories or interests within the TSA. Under the Forest Act, a cultural heritage resource means 'an object, a site or the location of a traditional societal practice that is of historical, cultural or archaeological significance to British Columbia, a community or an aboriginal community'. Archaeological sites and culturally modified trees that predate 1846 are protected under the *Heritage Conservation Act*. The nature and extent of required protection of archaeological sites are detailed under this legislation.

An Archaeological Overview Assessment (AOA) was completed for the Quesnel Forest District in 1998. This assessment provides a source of information for the District Manager to consider in deciding where more extensive archaeological work is required prior to road building or harvesting. In consultation with the Archaeology Branch of the Ministry of Small Business, Tourism and Culture, appropriate mitigation measures will be taken where archaeological sites are found. Most archaeological sites are found on gentle

slopes and near water bodies, in areas high in fish and game. These areas often coincide with and can be protected by riparian reserve zones or wildlife tree patches, with little or no impact on the timber supply.

The Kluskus First Nations' Traditional Use Study (TUS), completed in March 1999, reported 392 Traditional Use sites and 12 areas, with concern identified for 7 sacred sites and 32 spiritual sites. In public input it was submitted that this study was a pilot project, that more extensive and comprehensive study is required as soon as possible, and that these and other traditional use and archaeological sites need to be protected.

Again, due to the frequent overlap of cultural heritage sites with areas already removed from the timber harvesting land base or subjected to restrictive cover constraints in respect of other forest values, it is often possible to avoid harvesting near these sites as required, without affecting the timber supply.

To date, accommodating a good number of known cultural heritage sites (29 were identified by one licensee last year) has resulted in minimal impact on the size of the timber harvesting land base. For this reason, in the timber supply analysis for the Quesnel TSA, no specific constraints or deductions were applied to account for cultural heritage resources.

In view of the proven overlaps with excluded areas to date, I consider the absence of specific exclusions for cultural heritage resources to be appropriate for this AAC determination. From the sensitivity analysis described earlier which showed that the 'worst-case' elevated harvest level could be attained for ten years with the size of the timber harvesting land base reduced by as much as 10 percent, I believe any smaller reduction in the harvestable area in the TSA due to avoidance of areas of traditional use and archaeological significance can be accommodated without adjustment to the projected timber supply.

- identified wildlife

Under the *Forest Practices Code of British Columbia Act*, Identified Wildlife are those wildlife species and plant communities that have been approved by the chief forester and deputy minister of Environment, Lands and Parks or designate as requiring special management. The province's Identified Wildlife Management Strategy (IWMS) for dealing with endangered, threatened, vulnerable, and regionally significant species which have not been accounted for with existing management strategies—such as those for biodiversity, riparian management, ungulate winter range or through the application of other forest cover constraints—was announced on February 19, 1999. The following have been identified in Volume 1 of the Identified Wildlife Management Strategy as species at risk that require special management and potentially occur in the Cariboo Forest Region and the Quesnel Forest District.

fish	birds	mammals
bull trout	American white pelican; American bittern; sandhill crane; long-billed curlew; bobolink; northern goshawk	fisher; grizzly bear; mountain goat

In the area covered by the CCLUP, management objectives for identified wildlife are required to be achieved without compromising the targets established in the plan for timber supply. To this end, it is expected that management for identified fish, birds and mammals will be accommodated within the area-based HLP targets available for management of non-timber values (equivalent excluded area). Where possible, areas needed to manage for identified species will be overlapped with provisions for other non-timber values, such as riparian areas, wildlife tree patches (WTPs), and old-growth management areas (OGMAs). Where this is not possible the WHA impact will be managed within the total impact allowed for non-timber values on the HLP targets. A strategy now being developed for the management of grizzly bears is expected to have only minor impacts to timber supply that can be managed within the provisions of the land use plan. Fishers are expected to be managed within planned provisions for retained forest cover including OGMAs. Specific requirements for mountain goats—which primarily inhabit areas of higher elevation—are not expected to significantly affect the timber supply.

The CCLUP lists the three Kluskus lakes and Pantage lake as important feeding lakes for pelicans. In the recent interim lakes classification completed for the district, the Kluskus lakes were classified as 'class A' lakes, requiring a 200 metre 'no-harvest' riparian reserve zone, which was reflected in the timber supply analysis (see below, *-riparian habitats*). Pantage lake was classified as a 'class B' lake, but in the analysis was also assumed to have a 200-metre 'no-harvest' zone. Beyond recognizing these and the other habitat and forest cover requirements discussed in this document, the timber supply analysis incorporated no specific constraints for the management of identified wildlife.

From the foregoing I have reasoned as follows. The species in the TSA that potentially require special consideration under the IWMS have been identified, as have some elements of the means for meeting objectives for those species. However, the ultimate extent of the forest cover provisions necessary for their management, and the degree to which these may be accomplished within anticipated components of sub-regional plans in support of the CCLUP cannot be determined until these plans are complete. My usual approach to uncertainty in this regard is to rely on the recognition by government that the implementation of the IWMS will have a maximum impact of one-percent on the provincial timber supply, and to make an equivalent allowance in my determination. However, the government-approved intention of the CCLUP is to manage for these species within the provisions of the plan, which include specified limits on impacts to the timber supply. In this case therefore, pending the development of sub-regional strategies and subsequent analysis, I have assumed that the CCLUP contains adequate provisions for meeting objectives for identified wildlife species.

- mule deer winter range

To reflect the objectives of the CCLUP's Mule Deer Strategy and the CCLUP Integration Report, a complex series of harvesting constraints was applied in the timber supply analysis to a mule deer winter range (MDWR) zone covering approximately 5 percent of the timber harvesting land base. In the analysis, area control was employed to regulate the selection and partial harvesting, rather than forest cover requirements.

A risk assessment of the state of the crown closure in the ranges was performed for the CCLUP. The assessment showed a need to prescribe no harvesting in all ranges in the

Quesnel TSA for a period of 20 to fifty years, so that stands may develop into better wildlife habitat.

To account for areas totalling 1.9 percent of the timber harvesting land base, in which selection harvesting will be practiced in stands comprising 40-percent or more fir, these constraints required 50 or 80 percent of the mature volume to be retained at all times, with harvesting entries permitted only every 30 to 50 years, depending on the extent of 'crown closure' in the forest. Specifically, for 'moderate' and 'high' crown closure management (once canopy closure requirements are met after the required deferral) for age classes 6 and greater, after the first 20-percent removal of fir, entries were assumed every 50 years to remove only the growth produced since the previous entry. For this purpose, to reflect the selection harvest, growth was estimated at 66 percent of the mean annual increment of 2.03 cubic metres per hectare per year. For 'low' crown closure management, an 'initial' 50-percent removal was assumed (again, after the required deferral), followed by entries every 30 years to remove growth estimated at 1.35 cubic metres per hectare per year. Appropriate delays—calculated with the use of site indices to determine current crown closure, and area-based forest-cover constraints to determine crown-closure targets—were incorporated to ensure the attainment of crown-closure requirements prior to the initial harvest, in accordance with the risk assessment contained in the mule deer strategy.

On the remaining 3.1 percent of the land base in the zone, pine stands with less than 40-percent fir were assumed to be managed by an even-aged silvicultural system with no additional harvest restriction beyond the provision of WTPs. The intended management objective for these stands is to convert them over time to a greater than 40-percent composition of Douglas-fir. District staff feel this process may take 2 to 3 rotations.

To meet landscape-level biodiversity targets, in the MDWR zone 25 percent of the managed stands were kept at or above the 'old-seral' biodiversity target age, and 50 percent of the managed stands were kept at or above the 'mature-plus-old' seral biodiversity target age.

In practice, the CCLUP objectives for mule deer are intended to be met even if harvest levels are increased to manage the MPB infestation.

I have reviewed the methodology employed in the analysis to represent how the MDWR is currently expected to be managed in consistency with the CCLUP. While the constraints employed are essentially proxies for actual management strategies, in the absence of specific plans within the zone I consider the constraints as applied to be as careful a representation as currently possible. Since the constraints are in any case applied to only 1.9 percent of the timber harvesting land base, any inaccuracy is unlikely to significantly affect the overall timber supply projection.

- caribou habitat

Caribou habitat in the Eastern and Itcha-Ilgachuz areas of the TSA was represented in the timber supply analysis in accordance with the CCLUP Caribou Strategy, the CCLUP Integration Report (CCLUPIR), and the zone adjustments in the Eastern and Itcha-Ilgachuz Caribou Strategy 1998 update.

Current direction under the CCLUP caribou strategy prohibits timber harvesting in 65 percent of the identified caribou habitat area, and this was reflected in the analysis by the exclusion of 71 026 hectares in the derivation of the timber harvesting land base. (The

'up-to 10-percent' salvage harvest permitted in this area by the CCLUPIR was not modelled due to the unknown location and characteristics of such timber.) For the remaining 35 percent, the CCLUP permits access for harvesting by specific silvicultural systems: irregular group shelterwood in the terrestrial lichen sites in the Itcha-Ilgatchuz caribou area, and partial cutting in the arboreal lichen sites in the Itcha-Ilgathuz area and in the Eastern caribou area. To reflect these systems in the analysis, maximum volume removals were imposed—50 percent in shelterwood system areas and 33 percent in the partial cutting areas—and periods of 70 and 80 years were required between harvesting entries for the respective systems.

In addition, to avoid harvest concentration the CCLUP restricts the disturbance allowed every 20 years in each affected landscape unit to a maximum of 33 percent of the 'modified harvest area'. This was accounted for in the analysis by requiring proportionate harvesting by landscape period over the 20-year period.

It was assumed that use of the recommended silviculture systems will maintain forest stands at or above 'mature', but below 'old' seral biodiversity target ages.

One objective of these regimes is to create a checkerboard of small openings in which adequate shade remains to protect lichens. The increased shading effect of this condition on the regeneration of pine stands was accounted for in the analysis by the use of the VDYP model rather than TIPSY to project growth and yield in the regeneration of these stands.

From my discussion of these issues with staff of the Quesnel Forest District and with the MELP Forest Ecosystem Specialist for the area, I am satisfied that appropriate attempts have been made to apply constraints in the analysis that closely reflect the current practices designed to achieve management of caribou habitat in accordance with the CCLUP.

- riparian habitats

Riparian habitats occur along streams and around lakes and wetlands. The Forest Practices Code requires the establishment of riparian reserve zones that *exclude* timber harvesting, and riparian management zones that *restrict* timber harvesting, in order to protect riparian and aquatic habitats. Stream classes described in the *Riparian Management Area Guidebook* are determined, to estimate the area needed in riparian reserves and riparian management zones.

Riparian reserve zones: To determine the amount of riparian reserve required within the TSA, the stream, lake and wetland classifications of the Operational Planning Regulation were used by district staff to inventory and establish riparian reserves on 54 sample mapsheets (developed for the ongoing Kluskus Sub-regional plan), representing predominantly Crown forest. By extrapolation from this it was determined that riparian reserves for streams represented 0.92 percent of the productive forest in the TSA. A similar analysis for wetlands and lakes identified 1.43 percent of the productive forest in riparian reserves. The resulting total of 30 041 hectares of riparian reserve area required a specific deduction (net of overlaps with prior deductions for other management objectives) of 26 602 hectares of productive forest land in deriving the timber harvesting land base for the TSA.

Riparian Management Areas: In the same study, information was also collected on riparian management zones for streams and lakes (excluding the Class A lakes discussed

below). From this, 47 754 hectares of riparian management area were identified. After applying percentage retention factors to represent the partial availability of these areas for harvesting, a specific deduction of 15 787 hectares (again, net of overlaps) was applied to the productive forest land base to account for riparian management areas.

In public input, licensees questioned whether the 54 mapsheets are a representative sample of the TSA. District staff advise that a field review of the stream class estimates shows them to be 'quite accurate' for the area reviewed, and also expect the estimates to be quite representative of the central and western supply blocks. Staff acknowledge there may not be close representation of eastern areas of the TSA, but note that better information should be available for the next timber supply analysis. Licensees also submitted that they should have access to all the volume from within riparian management areas, to be managed over one rotation. I cannot agree with this, as it would be contrary to current management.

From my experience with the topography of this area, since the stream classifications in the east tend to be generally higher than in the west, I would consider it likely that basing the overall requirements for the TSA on western mapsheets could lead to some degree of underestimation in the total lineal distribution of streams, and thus in the overall constraint. However, this is offset by the fact that only 10 percent of the timber harvesting land base lies east of the Fraser River, and that the Kluskus does include some mountainous terrain in the Itcha-Ilgachuz area. I encourage the collection of more field information to reduce uncertainty in this area for future determinations, but in the absence of more specific data, I am satisfied that riparian management for streams, lakes and wetlands has been accounted for using the best available information and that the timber supply implications of any incorporated error are likely small.

Class A lakes: Lake classification has been completed for all L1 lakes within the TSA. For Class A lakes, in addition to the normally required 10-metre riparian reserve, a further 200-metre riparian management zone is required as a result of the district lakes classification, in which no harvesting is permitted. This results in a 210-metre 'no-harvest' zone for all Class A lakes. These areas were mapped, and consequently, in deriving the timber harvesting land base, two separate land base reductions (in respect of the 10-metre and 200-metre requirements) totalling 2206 hectares were made to the productive forest land for the management of Class A lakes including requirements for pelicans, as noted earlier under - *identified wildlife*. From this I am satisfied that the additional riparian management requirements for Class A lakes in the TSA have also been appropriately accounted for in the timber supply projections I have considered in making this determination.

- Lower Blackwater Local Resource Use Plan

A local resource use plan (LRUP) is a plan usually approved by the district manager for a portion of the provincial forest that provides area-specific resource management objectives for integrating resource use in the area. These plans are prepared pursuant to section 4 (c) of the Ministry of Forests Act.

The Quesnel TSA includes the Lower Blackwater LRUP area. Zone 1 of this LRUP covers 3364 hectares and is managed primarily for fish, wildlife and recreation values. Ninety percent of this zone is unavailable for timber harvesting. The remaining 10 percent—336 hectares—is available for harvesting, but only under the constraints applied to meet 'partial retention' visual quality objectives. Under these constraints, 85 percent of

the area must be maintained in forest cover at least 3 metres tall at all times. The zone contains a portion of a prominent recreation feature, the Alexander Mackenzie Heritage Trail (most of which lies in the adjacent Prince George Forest District). Part of this trail, extends beyond the boundaries of Zone 1, occupying approximately 2241 hectares of productive Crown forest land that could otherwise be considered part of the timber harvesting land base.

Both the LRUP and the trail predated and are accounted for in the CCLUP. However, due to delays in updating inventory files, in deriving the timber harvesting land base for the current analysis deductions accounting for Zone 1 of the LRUP and for the portions of Alexander Mackenzie Heritage Trail in the Quesnel TSA were inadvertently omitted.

I agree that this has resulted in an overstatement of the timber harvesting land base by a net area of approximately 5300 hectares, and I have taken this into account in my determination as discussed in 'Reasons for Decision'.

- Cariboo River Wildlife Management Area

The Cariboo River Management area covers 7633 hectares, of which 4989 hectares lie in the timber harvesting land base. To ensure that wildlife habitat values are maintained in the area, a specific forest cover constraint is applied operationally. This constraint limits the timber harvest from the area to an 'even-flow' volume obtained over 120 years, and requires that at least 85 percent of the timber harvesting land base in the area be maintained at a greened-up height of at least 3 metres at all times. I am advised by District staff that a concern at the data package stage about extending the rotation under the constraint as originally specified was reviewed together with the objectives of the Cariboo River Wildlife Management Area, and that the constraint was consequently adjusted to its current form.

The revised constraint was modelled in the analysis by allowing a maximum of one-twelfth of the area of the timber harvesting land base to be harvested every 10 years. I am satisfied that this provides in the analysis an adequate proxy for the constraint applied operationally in recognition of the need to maintain wildlife habitat in this area.

- stand-level biodiversity

Biological diversity, or biodiversity, is defined as the full range of living organisms, in all their forms and levels of organization, and includes the diversity of genes, species and ecosystems, and the evolutionary and functional processes that link them. Under the Forest Practices Code, biodiversity in a given management unit is assessed and managed at the stand and landscape levels.

Stand-level biodiversity is managed in part by retaining reserves of mature timber or wildlife tree patches (WTP) within cutblocks and in adjacent inoperable and other retained areas to provide structural diversity and wildlife habitat. Where landscape unit planning has been completed and objectives have been set, Table A3.1 of the *Landscape Unit Planning Guide* provides requirements for the percentage of cutblocks to be retained in WTPs. Where landscape unit units have not been designated, retention requirements are provided by Table A3.2. Other provision for landscape-level biodiversity is made through the retention of coarse woody debris.

Draft landscape unit boundaries and objectives have been provided by the *CCLUP Biodiversity Conservation Strategy* for use in the regional subregional planning process and as information for landscape unit and operational planning. However, since the boundaries and objectives are still in draft form, and because landscape unit planning must be completed in the near future and is expected to be available for use in the next timber supply analysis, to avoid performing the same exercise twice, in the current analysis district staff decided to rely on (a) the *Forest Practices Code Timber Supply Analysis*, (MoF and MELP, February 1996), which included a specific study of the Quesnel TSA respecting WTPs, and (b) on a review by district staff of silviculture prescriptions, concluded in 1998.

The 1996 report indicated that (using table 20b of the *Biodiversity Guidebook*—table A3.2 of the *Landscape Unit Planning Guide*—for areas without designated landscape units) the level of retention of WTPs on previous cutblocks indicated a need for areas totalling 9 percent of all future cutblock areas to be retained as WTPs. The 1998 study of 10 percent of the silviculture prescriptions approved in the previous 18 months showed that one percent of the WTPs overlap with riparian reserves, leaving 8 percent to be established on the timber harvesting landbase. Consistent with the *Landscape Unit Planning Guide*, it was assumed that of this net area required for WTPs, half would be contributed by forest cover from inside, and half from outside, the timber harvesting land base. To account for the former contribution, a reduction of 37 315 hectares of productive forest was made in deriving the timber harvesting land base. Although 95 percent of the WTPs are expected to be greater than two hectares in area, they are not expected to contribute to 'old-seral' biodiversity requirements because in future rotations the original patches are expected to be harvested and replaced (at about the same time) by somewhat younger stands.

District staff advise that current practice includes attempts to ensure that WTPs consist of the same timber types as are being harvested, although this is becoming increasingly difficult to maintain while management is affected by the current massive MPB infestation. In view of the severity of this infestation, I would expect that some trees intended for WTPs will inevitably become brood trees for the beetle and will therefore need to be harvested. In this case, if 'green-attack' trees are targeted for harvesting, the retained structure on the landscape may consist unavoidably in some areas of dead 'red' or 'grey' attacked trees, or of less susceptible species.

In assessing the adequacy of the accounting in the analysis for stand-level biodiversity, I note that the required areas derived for WTPs (i) accounted for the proportions of each landscape unit that are harvestable and already harvested; (ii) accounted for overlaps with riparian areas; and (iii) assumed that 50 percent would be found outside the timber harvesting land base. For the present determination, therefore, aside from the unavoidable issue of differences in retained timber types, I am satisfied that the timber supply projections include an adequate accounting for stand-level biodiversity objectives.

- landscape-level biodiversity

Achieving landscape-level biodiversity objectives involves maintaining forests with a variety of patch sizes, seral stages, and forest stand attributes and structures, across a variety of ecosystems and landscapes. Managing for biodiversity is based in part on the principle that this—together with other provisions in the Forest Practices Code, such as riparian management, maintenance of wildlife trees, and other forest cover objectives as

discussed throughout this document—will provide for the habitat needs of most forest and range organisms. (Other particular species considered to be 'at risk' may require special management under the Identified Wildlife Management Strategy, discussed above in – *identified wildlife*.)

- landscape units and biodiversity emphasis:

The delineation and formal designation of 'landscape units' is a key component of sub-regional biodiversity management strategies. Chapter 5 of the Forest Practices Code publication *Higher Level Plans: Policy and Procedures* (December 1996 revision) outlines three biodiversity emphasis options (BEOs)—lower, intermediate and higher—for application in establishing biodiversity management objectives for a landscape unit. Each option is designed to provide a different level of natural biodiversity, and a different risk to the maintenance of elements of natural biodiversity, when finding an appropriate balance between biodiversity and timber supply in establishing the objectives.

The CCLUP *Biodiversity Conservation Strategy* and *Integration Report* have provided draft landscape unit boundaries and draft biodiversity emphasis options for use in the subregional planning process and as information for landscape-unit- and operational planning. The draft landscape units—with minor changes from the Cariboo Region Landscape Unit Plan Strategy (CRLUPS)—were referred to in the 1998 statutory decision makers' letter which provided licensees with direction on landscape level biodiversity in the preparation of forest development plans. This direction reflects current management and was therefore used in developing the base case of the timber supply analysis.

- seral stage cover requirements

A major consideration in managing for biodiversity at the landscape level is leaving sufficient and reasonably located patches of forest cover at various ages or 'seral stages', including old-growth forest, for species dependent on or strongly associated with these forests. Table 7, page 40 of the *CCLUP Biodiversity Conservation Strategy* provides seral stage definitions and forest cover target values for the CCLUP area. The seral stage targets for NDT4-IDF in the *Biodiversity Guidebook* (at Table 17, page 43) were modified by separating fir and pine groups and revising objectives consistent with local ecology.

The CCLUP provides that in areas of lower biodiversity emphasis in the Integrated Resource and Enhanced Development Management Zones where targets for old-seral-stage forest cannot be met, to avoid the economic and social consequences of halting timber harvesting, the target may be met by the end of two, 100-year rotations of the forest, by applying a 'draw-down', in which the area equivalent to the shortfall is recruited from younger forest and retained to eventually meet the target. The CCLUPIR specifically states that seral stage target draw-downs may be used only to address short-term timber access problems. A detailed, up-to-date analysis of current seral forest stages in the CCLUP area is underway.

Seral stage objectives currently are not met in a large number of landscape units in the Quesnel TSA. By modelling the timber supply both with and without 'draw-downs' the analysis showed that in both the base-case and the 'worst-case' projections, the projected timber supply could be met even if no 'draw-down' was allowed, because timber could be accessed from other areas. For the purposes of this analysis, the draw-down was applied as an area-weighted average of the requirements for all the Resource Management Zones within each landscape unit.

Although the current availability of timber is such that neither the base case nor the 'worst case' timber supply projection *required* a compromise of seral stage targets through a 'draw-down', nonetheless the MPB infestation could yet result in some cases in failure to meet objectives for 'mature-plus-old' and 'old' seral stages. An accelerated rate of harvest for MPB management as assumed in the 'worst-case' projection will result in a large proportion of some landscape units being denuded and converted to an early seral stage within a short time period. In heavily harvested landscape units this could adversely affect biodiversity values, particularly local populations of species of wildlife that are dependent on mature or old forest. Some could be adversely affected for much of the next rotation, due to reduced proportions of the mature forest with its standing and fallen large-diameter timber. I am advised that the fur-bearing species most likely to be affected by higher levels of harvesting are the two small mammals the (blue-listed) fisher and the pine marten. Other, more riparian species, such as the mink, otter, beaver, and muskrat could be relatively unaffected. Some species—including lynx, wolves, coyotes, foxes, moose, and deer—could in fact do well in the newly created larger areas of early seral forest.

Being mindful of these specific probable outcomes, in considering the adequacies of the provisions for landscape-level biodiversity and the representation of these provisions in the analysis as discussed so far, I note the following.

The provisions in question were identified in draft form in the *CCLUP Biodiversity Conservation Strategy* and as such are valid components of the CCLUP, although they remain subject to possible refinement and subsequent formal approval of sub-regional land-use plans. As such, in view of the history of the CCLUP, the extensive related work by public agencies, and the public involvement at every stage, I find that these landscape-level biodiversity provisions, although they are technically still draft and subject to possible change, are likely to form a more reliable basis for my considerations in this determination than would a simple reversion to the standard, general, default biodiversity emphasis options. The latter, in my estimation, would be likely to entail a greater departure from the currently expressed draft provisions than is likely to result from adjustments to plans at this advanced stage. For this reason I have departed from my general guiding principle respecting the need for formal approval of land use plans before incorporating their implications in timber supply projections. In the current case, I believe the intent of the plans to be in a sufficiently clear state of expression and with an adequate state of public confirmation to form the most reliable currently available basis for assessing this aspect of the timber supply.

With respect to the representation of provisions for landscape-level biodiversity in the analysis, I note that the draft landscape unit boundaries and objectives identified in the CCLUP were incorporated directly in the analysis. I also note that both the base case and the 'worst-case' projections could be achieved both without application of the 'draw-down' and with normal cutblock adjacency requirements still being met. From this I expect that, even under the accelerated harvest contemplated in the 'worst-case' scenario, the district manager should be able to find—within the physical limits imposed by the effects of the MPB infestation, opportunities in some cases to manage the location of retained forest cover to suit the habitat needs of the fisher and the pine marten.

In public input, First Nations stated concerns that (i) continued interruptions in the process of forest succession, which began with fire suppression and continue with clearcutting and silviculture prescriptions for lodgepole pine, cause problems for biodiversity; (ii) that

biodiversity is negatively affected by the use of herbicides; and (iii) that biodiversity must include people, as they are part of the forest and the land.

In response to (i), it is quite true that human activity has had and continues to have an impact on the structure and dynamics of forests in both coastal and interior forests in the province. Fire suppression, harvesting and extensive management related to pest infestations are clear examples of how natural progressions in forest characteristics, including changes in biodiversity, may be affected by management. This is in fact a natural consequence of accepting point (iii), that people are part of the forest and the land since governments have developed planning processes that incorporate public participation to define objectives for a range of forest values, including biodiversity and socio-economic and other benefits for humans. In most cases, realizing a benefit of one kind incurs some other form of cost, and planning, policies and objectives are intended to formalise the allowances and compromises that must always be made in integrating uses of the forest. In this, biodiversity will inevitably be altered to some degree because every forest value cannot be maximised, and any forest management strategy will favour some animals to the detriment of others. In the current situation, the CCLUP and the Forest Practices Code are intended to maintain acceptable levels of biodiversity, and the timber supply analysis that was carried out for this determination has examined options for managing the MPB infestation within a carefully applied representation of those specified provisions for biodiversity. From this, recognizing that different planning strategies could have resulted in other outcomes, I believe the current plans are one valid expression of the results of considerable public dialogue on these issues, and as such form a suitable basis for analysing the timber supply. With particular respect to the close relationship between humans and forest lands, all identified traditional uses of the forest by First Nations will be carefully taken into account in all forest planning, as I have noted in the - *cultural heritage* section of this document.

Regarding point (ii), the application of herbicides in forestry, I have addressed this question earlier, under 'Impediments to prompt regeneration – *brush competition'*, where I noted that planned applications require prior consultation with First Nations and other stakeholders and must be approved by MELP as within acceptable limits of risk to the environment and human health.

From all the foregoing, to this point I am satisfied that the requirements for landscape-level biodiversity as prescribed in the CCLUP and the Forest Practices Code, even under the current conditions of extreme MPB infestation, have been respected and incorporated as fully as possible in the timber supply analysis.

- aging of the forest cover outside the timber harvesting land base

One area in which I do have concern for accuracy of representation in the analysis is regarding the contribution to the forest cover requirements for biodiversity assumed to be made by forest stands outside the timber harvesting land base. In the timber supply analysis, these forests were assumed to continue to age over time until all exceeded 250 years of age. This is a somewhat unrealistic assumption, in that future natural disturbances—from beetles, most probably, and from fire—are likely to reduce the ability of these forests to meet biodiversity requirements. The implications of this for timber supply are complex and difficult to estimate in advance. However, since no allowance at all was made in the analysis for the aging of the forest outside the timber harvesting land

base, as noted in 'Reasons for Decision' I have decided to account for a consequent unquantified, moderate overestimation of the mid- and long-term timber supplies as projected in the analysis.

In the general climate of uncertainty regarding the impacts of the MPB, some of these issues may be more readily addressed following completion of the land use planning strategy.

(vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber;

Cariboo-Chilcotin Land-Use Plan

The Quesnel TSA is included in the area covered by the Cariboo Chilcotin Land-Use Plan (CCLUP) approved by Cabinet in October 1994. A Higher Level Plan (HLP) Order, making a number of components of the plan legally binding under the Forest Practices Code, was established by Cabinet in January 1996. Subsequently, an approved Integration Report was published in April 1998 to ensure compatibility between components of the CCLUP, following which a Variation to the HLP Order was issued in June, 1999. Forest development in the TSA is required to be consistent with the Higher Level Plan.

The CCLUP incorporates a number of components, including management strategies for caribou in the eastern and western areas of the TSA and for mule deer winter range, a biodiversity strategy, and sub-regional planning processes. Landscape unit planning is expected to be completed in 2003, at which time the currently draft landscape unit boundaries and objectives are expected to become legally established. For ongoing implementation of the CCLUP in the interim period before formal establishment of the boundaries and objectives, the Statutory Decision Makers issue direction to licensees periodically by letter, explaining how draft objectives and rules are to be interpreted for, and incorporated in, forest planning at the operational level. In formulating this direction they are advised by staff of the Land Use Coordination Office, the BCFS regional office, and MELP and consider information provided by the IAMC.

The British Columbia Forest Practices Board expressed concern in December 2000 over perceived inconsistencies between the HLP aspects of the CCLUP and its ongoing implementation. I am advised that, with minor exceptions, these concerns are generally not shared by the agencies mandated by government to monitor the implementation of the CCLUP—the Cariboo Mid-Coast Inter-Agency Management Committee (CMCIAMC) and the Cariboo-Chilcotin Regional Resources Board (CCRRB) (which includes representation from municipal governments, environmental organizations and other stakeholders)—or by the local forest products industry. I am also advised that clarification on some of the issues raised has been sought from government, and that other clarification may be provided as a matter of course at later stages in the formal planning process, including when sub-regional planning and landscape-unit planning are complete.

In assessing the acceptability of the representation of the objectives of the CCLUP in the current timber supply analysis, and the consequent reliability of the harvest level projections, I have noted the adequacy of the representation with respect to specific requirements of the CCLUP in other sections of this document, notably under 'Resource management objectives'. I have also noted that the access to harvestable timber in the

TSA is sufficient to support the projected harvest levels throughout both the base case and the 'worst-case' forecasts without requiring compromise in the CCLUP seral stage targets and that both projections could be achieved with or without a 'draw-down'. Throughout my considerations in this determination I have also been mindful that the requirement for forest development in the TSA to be consistent with aspects of the plan that incorporate HLP direction applies to any accelerated harvesting that may be required to control the spread of the MPB. I am assured that to the extent possible and as required, this will be addressed by shifting harvesting to infested MPB stands as a priority so that the remaining stands can continue to contribute to achieving the HLP targets. I am advised that if it becomes apparent that the beetle control measures represent a risk to achieving the HLP targets, then the BCFS will undertake to develop a transition strategy to ensure that these risks are minimized. Further, in such an event, the BCFS will keep the CCIAMC and the CCRRB informed of the control measures for the MPB, and will request their advice or direction as required to manage any risk to achieving the CCLUP targets and objectives.

From detailed discussions in the course of this determination, with BCFS staff including the timber supply analyst and regional planning staff, and with the MELP forest ecosystem specialist, I am satisfied that, based on the periodic direction given to licensees by the statutory decision makers as indicative of current practice, the requirements of the CCLUP—as these are currently understood and interpreted by those primarily responsible for its implementation—have been carefully and adequately represented in the timber supply analysis. In arriving at this conclusion I have taken into consideration the expression of concern by the Forest Practices Board, and I acknowledge that final clarification is outstanding on a number of implementation issues which are subject to differences in opinion. However, as noted above, a number of agencies involved in these issues, including those specifically mandated by government to monitor the implementation of the CCLUP, namely the CMCIAMC and the CCRRB, are largely satisfied by the interpretations and directions given at this stage. If further clarification of objectives—either in the interim by Cabinet, or upon the conclusion of sub-regional planning processes—results in alternative interpretations with significant changes in what is considered to be current practice, any consequent implications for timber supply can be taken into account appropriately in a subsequent analysis.

On the basis of the foregoing, I have accepted the representation of the objectives of the CCLUP in the timber supply analysis as adequate for my consideration in this AAC determination.

Planning deferrals

- Kluskus supply block

The Kluskus supply block covers 263 113 hectares near the western extremity of the Quesnel TSA and includes 139 005 hectares—13.6 percent—of the TSA's timber harvesting land base and provides a lower proportion, about 8 percent, of the productive capacity of the TSA. In the rationale document for the January 1996 AAC determination, reference was made to a disproportionately low contribution from this area to the total harvest in the TSA, resulting from a historic lack of operations associated with planning delays in the area. The potential was identified for these delays to cause increased harvesting pressure in other parts of the TSA, and concern was expressed over the degree

to which the timber supply from this area may reasonably be expected to continue to contribute to the AAC for the TSA.

In assessing this contribution for the purposes of the current determination, I have considered the following information. The CCLUP has resulted in the establishment in the Kluskus area of zones in which timber harvesting is either prohibited or required to be modified in respect of caribou habitat. This greatly restricts the contribution that could be made by this area to the timber supply in the TSA, even if it were developed to the full extent of the applied limitations.

A sub-regional plan for the Kluskus is now nearing completion and the Quesnel Forest District is leading a planning process that is likely to conclude in approval of the location for a main forest access road linking the west Kluskus area to Quesnel. Following numerous meetings and contacts between the Kluskus First Nation and BCFS district and regional staff, the First Nation has confirmed a desire for meaningful participation in planning, cutting and utilizing the harvest, and in obtaining harvesting tenure in the area. Other First Nations' operations in the western portion of the Kluskus, accessed from the west, are expected to commence in the winter of 2001-02. From this it is reasonable to assume that, in the near future, some level of operations may occur in the Kluskus, which may eventually become consistent with the timber supply contribution to be expected from the area under the strict requirements applied in respect of caribou and other forest values.

Given the historically low level of operations in the area, several interests have questioned whether a particular level of harvest should be specified as attributable to the Kluskus under a partitioned AAC, and I have considered this matter with care. Given the extended history of planning difficulties and the presence of problem forest types in the area, in a normal management situation I would support the use of a partitioned harvest level for this area, to avoid potential planning difficulties in other parts of the TSA. However, in the present determination I must place much weight on my consideration of the very urgent management objective of dealing with an epidemic beetle infestation in the TSA. In this situation, a considerable increase in the overall harvest level for the TSA is now contemplated, with harvest rates in many parts of the TSA likely to be elevated from normal levels for some time. In these circumstances the desirable objective of attempting to ensure a reasonably proportional distribution of harvesting in various parts of the TSA is temporarily overtaken by the need to ensure that sufficient amounts of harvest take place, in accordance with approved planning objectives, to deal with the implications of the MPB infestation, as discussed below, under '<u>Epidemic mountain pine beetle infestation</u>'.

From these considerations I have concluded as follows. From the encouraging recent and expected developments in the area, it is reasonable to assume there will be some level of continued contribution from the Kluskus to the timber supply in the TSA. Whether the Kluskus will in fact contribute under normal circumstances in full proportion to the timber supply projected to be available in the area is less clear. However, given the current urgency of dealing with the MPB epidemic in many parts of the TSA through increased harvesting levels, I have decided that—*at this time*—a partition would not usefully serve its intended purpose of distributing the harvest proportionally between this and other areas of the TSA. For this determination therefore, I will accept the timber supply as modelled, with the extensive constraints applied, as an appropriate representation for the Kluskus area. Any further developments or new information will be reviewed in the next analysis.

- Pulpwood Agreement PA 5

Pulpwood Agreement 5 (PA 5) overlaps a portion of the Quesnel TSA. Harvesting under PA 5 could affect the availability of mature timber for sawlog harvesting in the TSA by creating cut-over areas that must be reforested and meet green-up requirements before adjacent sawlog forests can be harvested. The harvest from problem forest types could similarly be affected. BCFS region and district staff advise that the extent and timing of any future harvesting under PA 5 are not clear at this time, that no harvesting has been conducted in the past, and that none is currently proposed for, or in their expectation likely to occur in, the near future.

No constraints were applied in the timber supply analysis to account for possible implications from harvesting under PA 5. In view of the current lack of any indication of any future harvesting taking place under PA 5, and in view of the general stability of the timber supply in this area in any case, I am satisfied that the harvest levels projected in the timber supply analysis require no adjustment at this time in respect of any potential harvesting under PA 5.

(b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area;

Alternative harvest flows

The nature of the transition from harvesting old growth to harvesting second growth is a major consideration in determining AACs in many parts of the province. In the short term, the presence of large volumes of older forests often permits harvesting above long-term levels without jeopardizing future timber supply. In keeping with the objectives of good forest stewardship, AACs in British Columbia have been and continue to be determined to ensure that current and medium-term harvest levels will be compatible with a smooth transition toward the usually (but not always) lower long-term harvest level. Thus, timber supply should remain sufficiently stable so that there will be no inordinately adverse impacts on current or future generations. To achieve this, the AAC determined must not be so high as to cause later disruptive shortfalls in supply nor so low as to cause immediate social and economic impacts that are not required to maintain forest productivity and future harvest stability.

For the Quesnel TSA I have considered eight alternative timber supply projections and a number of related sensitivity analyses. In view of the important relationships between the eight alternative timber supply forecasts and the management of various aspects of the MPB infestation, details of the alternative forecasts are described in the section '<u>Epidemic mountain pine beetle Infestation</u>—*timber supply analysis—alternative projections'*, below, and in the interests of brevity are not repeated here. I have reviewed all of these projections with respect to consistency with current management including interpretations of the objectives for the CCLUP, as discussed in earlier sections of this document, and with respect to the implications of the MPB infestation for the projected timber supply in the short, medium and long terms. The eight projections all meet the planning and forest cover requirements of the CCLUP and include examinations of the timber supply with and without the presence of beetles and under various assumptions about the rate of spread of the MPB infestation.

As discussed in the noted section, I have relied for most of my considerations in this determination on projection No. 6 of the eight projections, labelled the 'worst-case' scenario. This projection confirms the high level of stability of the timber supply in the TSA. It shows that a temporary increase of one million cubic metres annually in the harvest level for the TSA can be sustained for 10 years while meeting all forest cover requirements, without undesirable consequences for future timber supply, and with very significant advantages for controlling the rate of spread of the MPB infestation, for salvaging damaged timber, and for reducing associated lasting harmful consequences to multiple forest management objectives.

Two points related to the projections require noting here. First, the harvest level of 40 000 cubic metres attributable to deciduous stands could only be maintained for the first 130 years in both the base case and 'worst-case' projections, which is reflected in my determination as discussed in 'Reasons for Decision'. Second, in relying on the 'worst-case' projection as a point of reference for my considerations, I have taken into account the harvest flow implications of a range of uncertainties related to specific considerations as noted throughout this document. In particular, implications for habitat requirements are discussed under 'Resource management objectives'. Implications for the community, the forest industry and economic and social indicators are addressed next.

Community dependence on the forest industry

The socio-economic assessment for the Quesnel TSA indicates that the current AAC of 2 340 000 cubic metres per year can support a provincial total of approximately 1678 person-years of direct employment. Residents of the Quesnel TSA account for about 90 percent of this direct employment. Direct forest sector activity in the TSA supports a further 2246 person-years of indirect and induced employment across the province. The current AAC provides the provincial government with average annual revenues of 106.4 million dollars.

As shown in the analysis, the harvest level could be increased to 3 340 000 cubic metres per year for ten years. This volume would support an estimated total of 2395 person-years of direct employment in the forestry sector, and a total of 3207 person-years of indirect and induced employment in the province. The higher harvest level could provide the provincial government with average annual revenues of 151.9 million dollars.

Even higher increases in the harvest level have been shown to be sustainable for ten years without significant future disruption in the timber supply. I have discussed my assessment of the implications of these levels under 'Epidemic mountain pine beetle infestation' (forecasts Nos. 7 and 8) and my reasons for rejecting these as suitable harvest levels on which to base my AAC determination *at this time*.

In public input, First Nations drew attention to the fact that the proposed increases are clearly unsustainable, will lead to an economic 'boom' that will be 'difficult to scale back' and will not give future generations the same level of prosperity. I agree with each of these legitimate points of view and in my determination I have accounted for them carefully in context of the urgency of the need to minimize the overall damage brought about by the MPB in the TSA. Specifically, in the timber supply analysis the elevated harvest level is indicated to be sustained for ten years only. I have noted elsewhere that during that time,

even with elevated harvest levels, it could be possible for the MPB to attack all susceptible lodgepole pine stands on the timber harvesting land base. The elevated harvest levels now under consideration are not contemplated as sustainable levels; rather they are temporary, extraordinary measures designed to deal with an extraordinarily widespread MPB attack, and to contain any negative consequences to the extent possible. Increased levels of socio-economic activity will occur for the duration of the elevated harvest and will necessitate adjustment when the cut subsequently declines. To avoid worsening this and related problems, I have concluded that an AAC at either of the higher harvest levels in forecasts Nos. 7 and 8 would be inappropriate at this time. It is true that the levels of activity contemplated over the next few years are not projected to be repeated in current forecasts. However, the activities now contemplated are expected to leave the forests in a better, less damaged condition for the future than if no additional effort were made at this time to contain the MPB and to salvage the killed timber. Thus, as further discussed throughout this document, despite the noted concerns I have considered a temporary significant increase in harvest level to be an appropriate response to the current epidemic infestation.

(c) the nature, production capabilities and timber requirements of established and proposed timber processing facilities;

Timber processing facilities

Existing facilities: Twelve wood-processing facilities, including lumber mills, veneer and plywood operations, and two log-home operations, are located in the Quesnel area. Their estimated combined annual processing capacity of 2 891 000 cubic metres (based on 480 8-hour shifts per year) exceeds the current AAC of 2 340 000 cubic metres for the TSA. Also located in the Quesnel area are two pulp mills, a medium density fibreboard (MDF) operation, with an estimated total annual capacity (based on 345 24-hour days per year) of 1 120 000 bone-dry units of chips and wood-waste, and a fuel-producing operation for wood-pellet stoves. Several value-added manufacturing plants are operated by major mills as joint ventures with First Nations companies.

District staff advise that the total current consumption by facilities processing problem forest types (PFTs) is 402 500 cubic metres, and that for sawlogs is 3 060 000 cubic metres—exceeding the estimated capacity due to an increased number of shifts. One licensee holding a small (46 000-cubic-metre) forest licence has no mill in the Quesnel TSA but has ample milling capacity in Prince George.

Proposed facilities: In public input it was noted that one company is building a facility to make laminated panels out of pine and birch as well as furniture cut-stock from birch, and that some demand exists for exports of aspen products.

First Nations noted that future mill capabilities may differ from those of today, and expressed concern that removing 'green-attack' timber (for definition, see below, 'Epidemic mountain pine beetle infestation'), would prevent the harvesting of naturally dry wood for which there is a demand by two businesses in Vanderhoof and Houston, and an increased demand for home heating.

I have reviewed in detail and discussed with the BCFS regional and district managers the capabilities of facilities in the area under various shift levels. At present the demand is high for all log products in the Quesnel area—not only those originating from the TSA but

also from two local tree farm licences, woodlot licences and the SBFEP—and appropriate facilities are in place for their processing. However, the Quesnel Forest District Manager considers that even with additional shifts the local facilities are probably not capable of processing the entirety of a one-million-cubic-metre increase in harvest level in the TSA, and that much of the additional volume will leave the district for processing. From discussions with BCFS staff, who have discussed mill capacities with local mill management, in general, I am satisfied that the additional volumes of harvested wood under the contemplated one-million-cubic-metre increase can be processed in the existing facilities either in the region, or dispersed into the flow of timber for processing at various locations within the province. I am advised that in order to maintain stability for local operators under these conditions, applications for licences to harvest the increase will require demonstration of how prospective licensees will deal with the increased harvest without reducing purchases from the SBFEP.

With respect to the availability of dry wood, I believe that the management of damage from the MPB must remain a priority in the TSA, and that the problem of access to dry wood can be solved through a suitable sorting process. Also, as noted earlier under – *deciduous forest types*, the AAC I determine will provide sufficient volume to meet current and expected demand for a harvest of deciduous species.

(d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia;

Minister's letter and memorandum

The Minister has expressed the economic and social objectives of the Crown for the province in two documents to the chief forester—a letter dated July 28, 1994, (attached as Appendix 3) and a memorandum dated February 26, 1996, (attached as Appendix 4). This letter and memorandum together include references to forest investments, forest stewardship, a stable timber supply, and allowance of time for communities to adjust to harvest-level changes in a managed transition from old-growth to second-growth forests, so as to provide for community stability.

The Minister stated in his letter of July 28, 1994, that "any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability." He placed particular emphasis on the importance of long-term community stability and the continued availability of good forest jobs. To this end he asked that the chief forester consider the potential impacts on timber supply of commercial thinning and harvesting in previously uneconomical areas. To encourage this the Minister suggested consideration of partitioned AACs.

The government's objective with respect to reductions in AACs is not directly applicable in this TSA at this time as no immediate AAC reduction is contemplated. However, the temporary increase under consideration is projected to be followed by an equivalent decrease (in two steps), and in determining this AAC I have been mindful of the government's objective with respect to the size of the eventual reductions. As discussed earlier in 'Community dependence on the forest industry' and below in 'Epidemic mountain pine beetle infestation', I have considered and rejected the possibility of AAC increases at this time amounting to three and four million cubic metres per year, which

would eventually incur greater reductions than the one-million increase which has formed the main basis of consideration in this determination.

With respect to commercial thinning, I have noted that this has been tried in the TSA, but that the economics are currently not advantageous. Partitioned harvests attributable to problem forest types and to deciduous species are already in effect in the TSA, and also form integral parts of the current AAC determination as noted in the appropriate sections and in 'Reasons for Decision'.

The Minister's memorandum addressed the effects of visual resource management on timber supply. In it, the Minister asked that pre-Code constraints applied to timber supply in order to meet VQOs be re-examined when determining AACs in order to ensure they do not unreasonably restrict timber supply. In the case of the Quesnel TSA, as discussed under *visually sensitive areas*, the CCLUP includes broad requirements implying that eventually more extensive visually sensitive areas may need to be accounted for, but also sets limits on the permissible impact these may have on timber harvest levels. Clearly the eventual visual quality requirements approved under the CCLUP will be consistent with government's own objectives, and in the meantime the current timber supply analysis accounts for all areas now made known to licensees, and reflects all the management constraints to which licensees are presently required to adhere.

One additional socio-economic consideration in this determination is that under the proposed higher harvest level fur-bearer populations in heavily harvested landscape units will significantly drop, resulting in economic losses to affected trappers. Not harvesting some of the beetle-affected stands would result in fur-bearer populations in some areas being less strongly affected. Such actions may be considered in operational planning.

Local objectives

The Minister's letter of July 28, 1994, suggests that the chief forester should consider important social and economic objectives that may be derived from the public input in the timber supply review where these are consistent with government's broader objectives.

In the abbreviated timber supply review process for the Quesnel TSA, the BCFS provided a number of opportunities for public review and comment on the *Data Package and Information Report* in June 1999, and on the *Quesnel Timber Supply Area Analysis Report and Information for Urgent Allowable Annual Cut Increase*, released in February 2001. About 70 copies of these reports were mailed to local governments and Members of the Legislative Assembly, First Nations, licensees, forest workers, environmental groups, ranchers, consultants and interested individuals in the Quesnel and other adjacent TSAs. Information meetings and open houses were held, copies of the documents were provided to local media, and their availability was advertised.

In response, twelve submissions were received, from the forest industry, local government, First Nations, interest groups and the general public. I have reviewed the submitted information in summarised form. Wherever possible, I have attempted in the appropriate sections of this rationale to respond briefly to the views expressed, and consideration of this input has been an important component of this determination.

(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

Epidemic mountain pine beetle infestation

- the beetle

The mountain pine beetle (MPB), *Dendroctonus ponderosae* Hopkins (Coleoptera: Scolytidae) is widely considered to be the most damaging of all the insects that attack lodgepole pine in western Canada. The insect is a small, cylindrical-shaped bark beetle that kills mature trees by boring through the bark, mining the phloem—the layer between the bark and the cambium or inner wood of a tree—and interrupting the flow of nutrients up the tree stem. Details of its life cycle and its devastating power in destroying forests are presented in Appendix 3 to this document, *Forest Insect and Disease Survey, Forest Pest Leaflet No. 76*, a Forestry Canada publication, from which the following extract is taken:

> Tree foliage begins to dry out as soon as the conduction of water up the tree is interrupted. As a result, the color of the foliage on infested trees gradually changes from bright to dull green. This early symptom in the lower crown will often become visible 2-3 months after attack. However, more distinct color changes occur during the onset of the growing season the spring following attack. Most lodgepole pine change from yellowish green to an orangey red by July and rusty brown by late summer. At this time most of the beetles will have left the tree. Other tree species display varying color patterns: ponderosa pine seldom turns red but develops more of a straw color, while white pine tends to become bright red. With time, retained foliage color becomes more dull, and most of the foliage drops in 2-3 years; this will vary from species to species and with weather conditions. These rapid and distinct color changes are used to schedule aerial mapping of recently attacked trees.

- mapping the extent of the impact of the MPB in the Quesnel TSA

The mapping of MPB attacks in stands of predominantly lodgepole pine is usually carried out to show the three stages of advancement through the colour changes noted above, as follows:

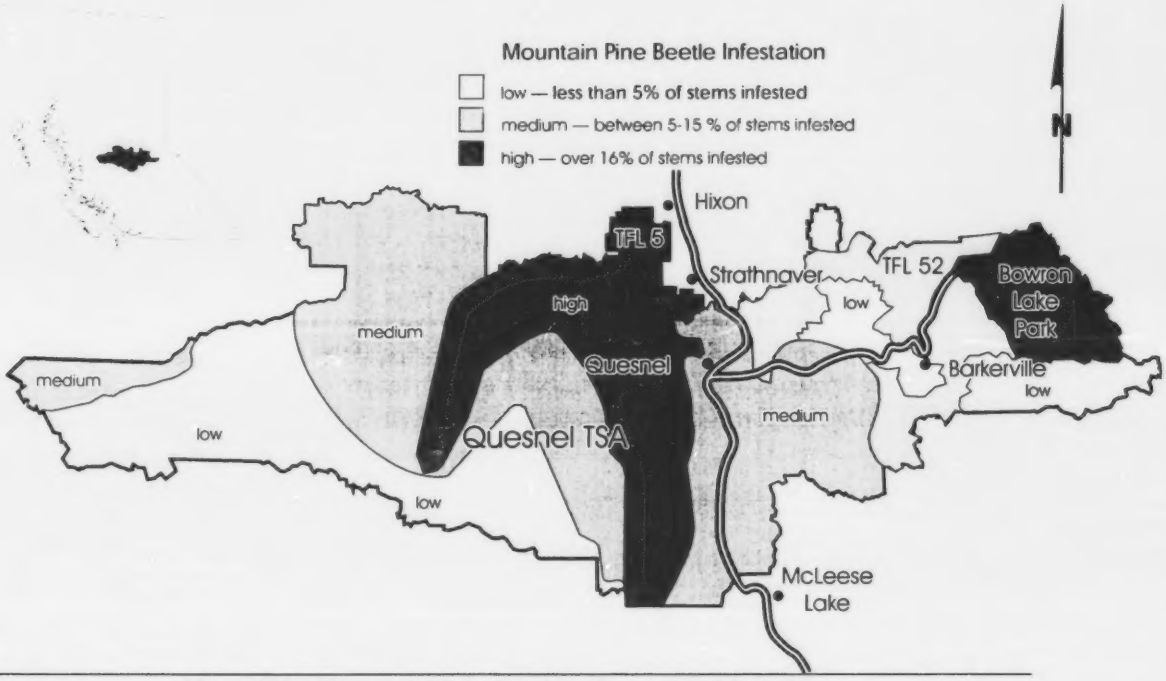
- '*green-attack*' in the first year, during which the insect migrates to and establishes 'brood trees' (where larvae will later mature into adults and eventually spread again to surrounding trees)—this stage is less readily identifiable visually from a distance than are the later stages;
- '*red-attack*' in the next year, beginning in spring, when the already-attacked trees are obviously dying and clearly identifiable visually from a distance and from the air;
- '*grey attack*' in subsequent years when the trees are left standing dead without needles.

The MPB thrives in forests of mature lodgepole pine, and in the past two decades has widely infested British Columbia's Cariboo Forest Region. As I noted earlier in this document, in *-age-class distribution and species composition*, a large proportion of the Quesnel TSA's timber harvesting land base supports forest stands aged 80 years and higher, the majority of which are pine forests and highly susceptible to attack by the MPB.

Due to this abundant host material and to a series of mild winters that have failed to kill off the MPB larvae, the infestation has spread rapidly over the past ten years to reach epidemic

proportions today in the Quesnel TSA, where about 73 percent of the current infestation in the Cariboo region is now located. In this TSA, the area attacked by the MPB has grown from an estimated 33 hectares in 1991 to a cumulative figure of over 24 400 hectares mapped with infested trees remaining on the landscape, (mostly 'red-attack' with some 'green-attack', and net of all harvested attacked trees) up to the end of year 2000. Since the beetle flight in 2000, the populations have expanded further, and it is estimated that if this expansion continues at the 'average' rate experienced from 1994 to 2000—roughly 44 percent—then by the end of 2001 the mapped infested area visible on the landscape would extend to about 39 000 hectares after harvesting at current rates.

The substantial areas of the Quesnel TSA now covered by various intensities of the MPB infestation are shown in the figure below, which is based on the data for 2000.



Map of the Quesnel TSA showing the general location of the area infested by mountain pine beetles in 2001.

- map methodology

The method for identifying and describing the extent of the infestation in the Quesnel TSA is an aerial survey sketch-mapping process that has been used in the Cariboo Region since 1980 and conforms to the specifications outlined in the Cariboo Region's pest survey manual (Hamm 1995). Relevant technical details may be summarized as follows.

The survey covers 8.2 million hectares in the Cariboo Forest Region, using over 620 1:40 000 scale mapsheets. The locations of bark beetle infestation are marked on the maps, identifying either the estimated percentage of 'red-attack' trees in an area or the number of infested 'red-attack' trees. Some of the most intense infestation is mapped using oblique aerial photographs. Infestations are generally sketch-mapped as either a single point, showing the actual number of 'red-attack' trees, or as a forest cover polygon,

showing either the estimated number of trees attacked or the estimated percentage of the stand attacked, whichever is easier to estimate. Infestations that were digitized as a point and assigned a number of trees were given an area of 0.066 hectare for each infested tree. For analysing the infestations, only infestations of three or more trees were tabulated. Forest cover polygons were cross-referenced to the BCFS forest inventory planning (FIP) files to calculate the volumes of timber killed by the beetle. The 'volume killed' for a polygon was derived by determining the digitized area of the polygon, then multiplying this first by the percentage of infestation for the affected tree species, and then by the volume per hectare for that tree species. Where digital inventory data for a polygon was ascertained to be incorrect or absent, the average volume per hectare for the forest district was used to estimate the volume killed. Beetles mapped in areas classified as non-productive were assessed a zero killed volume. Stands with high environmental sensitivity due to soil instability, recreational, or wildlife values were assigned reduced volumes to reflect their lower commercial potential for timber production.

All surveys of this nature are inherently subject to some level of error, due to the large amount of subjective data, the inherent difficulty of the estimation required in the survey, and variations in the skill and experience of the persons carrying out the mapping. However, it is important to note that the methodology itself carries an inherent bias toward underestimating both the affected area and timber volume. First, the visual method relies on recognizing only the 'red-attack' areas, since the 'green-attack' cannot be detected from the air, while in 2000, surveys indicated that on average the ratio of the areas of 'green attack' to 'red attack' approached 10 to 1. Second, while only a few specific trees in a particular area may show as 'red-attack', a larger total volume of timber in healthy or 'green-attack' trees will also be required to be harvested in order to gain access to and remove the affected and adjacent trees to reduce the spread of the insect.

In making my determination of the AAC for the Quesnel TSA I have been mindful of these underestimations in the mapping of infested areas and in the subsequent analysis of the overall timber volumes affected by the MPB.

- *'controlling' the MPB*

As noted in Appendix 3, the Forestry Canada publication, several control methods may be effective for lower levels of infestation. Pheromones may be used to prevent the spread of beetles outside the affected area or to create trap trees to attract beetles. Individual 'brood trees' may be felled and burned, and approved pesticides may be applied under permit, before the MPB larvae have had time to mature and spread. A number of these methods have been applied in the Quesnel TSA.

However, as Forestry Canada notes in Appendix 3 to this document, these methods become ineffective at higher levels of infestation.

> At intermediate infestation levels (up to about 100 trees per patch), small-patch logging can be used if good access is in place, and if beetle attack is concentrated naturally or through the use of pheromone baits. Beyond the intermediate stage, and when infestations exceed 10 ha [hectares], control becomes increasingly more difficult. In larger infestations the rate and range of beetle dispersion increases and any effective control program will require very extensive ground surveys to locate the green, newly attacked trees. Consequently, the only practical control measure at this stage is

clearcutting well beyond the areas having red trees in order to remove trees containing beetles.

For the current epidemic level of infestation in the Quesnel TSA, the latter measure—'clearcutting well beyond the areas having red trees in order to remove trees containing beetles'—is the only option with operational advantage. This advantage is not in *eliminating* the infestation, which at its current level could only be achieved by a population collapse, either from very cold weather or from complete infestation of all susceptible host trees. However, intense control efforts focussed on the removal of active infestations can *slow* the MPB's population expansion, and can remove the large numbers of dead and dying trees from the landscape and salvage their commercial value while it remains. To this end, 8 000 hectares of infested timber are now harvested annually in the Quesnel TSA—this represents most of the current AAC. In neighbouring areas with unmanaged MPB infestations, the MPB has expanded at nearly twice the average rate in the TSA, providing an indication of the effectiveness of the management program of harvesting and falling and burning in the TSA. However, the current level of control is insufficient to prevent the infestation's serious threat to all susceptible stands in the TSA.

- seriousness of the current infestation

The seriousness of this epidemic and expanding MPB infestation and of its projected implications for the timber supply and other forest values in the Quesnel TSA may be summarized as follows.

The MPB prefers trees greater than 70 years of age and greater than 12.5 centimetres in diameter at breast height, and about 60 percent of the TSA's timber harvesting land base is comprised of lodgepole pine forests between the ages of 80 to 140 years. On this basis, excluding the Montane Spruce and Engelmann Spruce-Subalpine Fir biogeoclimatic zones, 321 000 hectares of high-risk mature lodgepole pine stands (over 80 years) in the timber harvesting land base are now threatened by the MPB.

In September 2000, the number of mapped infestations of three trees or greater in the Quesnel TSA was at least 21 700, of which 17 600 were less than a hectare in size. While many of the forest stands surveyed had very high ratios of 'green-attack' to 'red-attack' trees, other locations showed the MPB had moved into stands of predominantly small-diameter trees that are typically considered to be low-risk areas. This type of activity indicates intense pressure from the infestation. An average of 94 percent of the larvae are estimated to have survived the winter of 2000/2001. Staff have calculated (see bar chart below) that if the recent average rate of expansion continues, all susceptible pine stands in the timber harvesting land base will be attacked within 7 to nine years. This has serious implications for a range of forest values (see above, 'Resource management objectives') including the projected timber supply. Once stands are attacked in the Quesnel TSA, they are expected to lose their merchantability more quickly in the relatively moist climatic conditions than in the recent extensive infestation in the drier Chilcotin area. While some stands attacked 15 years ago in the Chilcotin remain merchantable, in the Quesnel it is expected that much merchantability could be lost much sooner.

- timber volumes affected

Assuming a reasonable average of 250 cubic metres of timber per hectare, the 24 000 hectares of primarily 'red-attack' infestation mapped in 2000 represent approximately 6

million cubic metres of already affected timber standing on the landscape. For the reasons discussed above, including the high ratio of 'green-attack' area to 'red-attack area', this is a very conservative estimate of the dead and dying timber. Given the area covered by susceptible lodgepole pine stands and the current rate of MPB expansion, at its peak in the next 7 to 9 years, the volume affected could increase by 10 million cubic metres per year. The future expansion rate is very uncertain, however, as it depends on factors such as the level and effectiveness of harvesting for control of the MPB, and most importantly, changing weather patterns. Based on current expansion projections, the MPB could affect up to 80 000 hectares per year, with a corresponding annually affected wood volume of about 20 million cubic metres, about half of which, 10 million cubic metres per year, is expected to be killed.

- current management strategy

Regional and district staff of the BCFS, and the local forest industry have been actively working to control and manage the MPB infestation. Since 1998, the management strategy has been to direct harvesting to infested stands as a priority so that the remaining stands can continue to contribute to achieving the HLP targets of the CCLUP. In 2000, the Cariboo Forest Region Mountain Pine Beetle Task Force was formed to assess the beetle epidemic and the effectiveness of past management strategies. Both industry and the BCFS continue to monitor and evaluate the MPB situation and management techniques with the objective of focusing harvest and other activities where they will be most effective in controlling the spread of the infestation.

The current strategy attempts to control the damage done by the beetle through maximizing the number of 'green-attack' trees harvested. This is achieved primarily through a clearcut silvicultural system that includes a variety of sizes of openings, as well as group- and single-tree removal and the falling and burning of infested trees. As 'red-attack' and 'green-attack' trees are generally found together in affected stands, there is a salvage component in the harvest, but the salvage is essentially a by-product of the control effort, not an end in itself. Approximately 85 percent of the harvesting in the district is directed towards beetle-infested stands. The other 15 percent meets the profile requirements of mills which cannot utilize a full diet of beetle-killed timber.

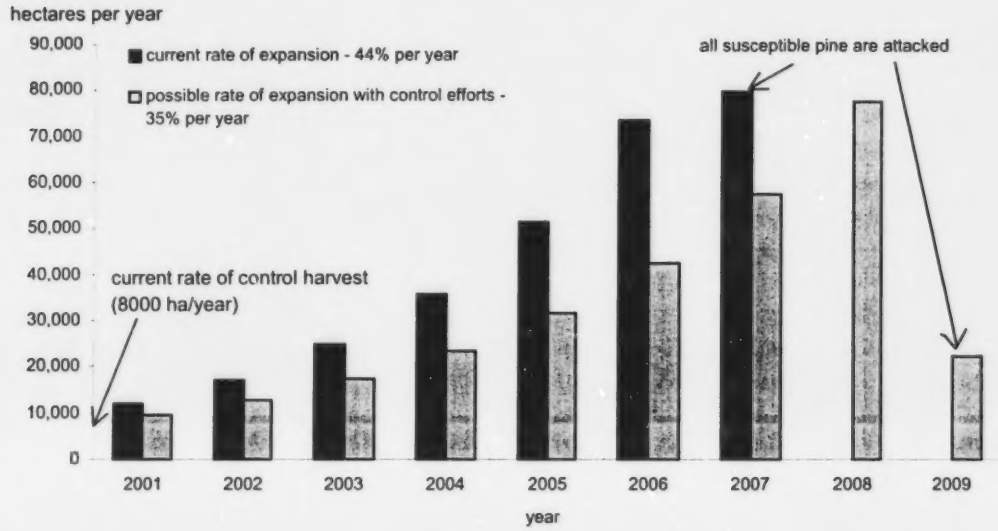
The harvesting of about 8000 hectares of infested timber annually under the current AAC has been insufficient to prevent the accumulation on the landscape of at least 6 million cubic metres of dead and dying timber. District staff have therefore contemplated the advantage of an increased level of harvest which, concentrated on the removal of brood-trees, could reduce the rate of spread of the epidemic by removing more of the 'green-attacked' trees and stands. Staff acknowledge that this measure would not eliminate the epidemic in the face of continued mild winters and abundant host material, but would reduce the overall extent of the damage until the MPB population collapses, and would permit recovery of at least part of the economic value of the killed timber.

- reducing the rate of spread

As noted earlier in Alternative harvest flows and as addressed below, a temporary harvest-level increase of one million cubic metres is under contemplation as a means of slowing the rate of spread of the MPB and of salvaging some remaining commercial value in the affected timber. It has been calculated that such a harvest increase could reduce the rate of

spread of the area of the MPB infestation from the 'average' 44-percent rate (ignoring wide yearly fluctuations) experienced over the past six years to about 35 percent.

The effects are graphed below under the two assumed conditions: (i) (black bars) assuming the experienced 'average' 44-percent rate, in which case all the 321 000 hectares of susceptible wood in the timber harvesting land base are attacked within seven years, and (ii) (grey bars) under the hypothetically reduced rate of expansion of 35percent associated with an increase of one million cubic metres in the harvest level, in which case all the wood is projected to be attacked in about 9 years.



Forecasts of the area per year infested by the mountain pine beetle in the Quesnel TSA

The graph shows that if control harvesting is increased by one million cubic metres and this results in a reduced average annual rate of spread from 44 percent to 35 percent, this might delay the infestation of all susceptible stands for one or two years. This conclusion is subject to uncertainties inherent in the mapping methodology and in the fluctuating rate of spread in dependence on weather. Nonetheless, the projected slower spread would provide more time to plan and manage operations and to remove more of the affected timber before the eventual loss of its value.

Since the TSA already holds about six million cubic metres of unsalvaged affected timber, I have carefully reviewed several analyses of alternative rates of harvest, including the noted million-cubic-metre increase, with respect both to consistency with current management including interpretations of the objectives for the CCLUP, as discussed in earlier sections of this document, and to the implications of the MPB infestation for the projected timber supply in the short, medium and long terms, as discussed in the following sections.

- timber supply analysis—assumptions

From the many complex assumptions on which the analyses were based and which I have reviewed in detail, the following are of particular note with respect to MPB management.

- In the model, forest cover requirements for visual quality, adjacency, and draft landscape unit biodiversity objectives under the CCLUP were applied in all alternative projections.
- It was assumed that after a stand has become infested it would remain merchantable for five years, after which its volume of merchantable timber would be reduced by 50 percent.
    - If the remaining volume per hectare then met specified criteria, it was assumed to be still merchantable as a 'Beetle kill Residual Area', and was assumed to remain in the timber supply for salvage harvest, after which it was assumed to regenerate as a managed stand (using TIPSY to estimate volumes).
    - Stands that did not meet merchantability criteria at this point were considered to be 'Unsalvaged Beetle Areas' requiring regeneration before becoming merchantable. Such stands were assigned an age of zero (i.e. with no further regeneration delay) and then assumed to exhibit the reduced growth characteristics of unmanaged stands (i.e. in the analysis, VDYP was used instead of TIPSY to estimate the eventually regenerated volumes. (In a sensitivity analysis noted in the next section these stands were subjected to a further regeneration delay of 10 years—i.e. 15 years from the time of infestation).

- timber supply analysis—alternative projections

1. *'Base case'*: In the base case projection (which assumed no MPB presence) a harvest level of 2.34 million cubic metres per year could be maintained for 19 decades before declining to a sustained long-term harvest level of 2.2 million cubic metres per year.
2. *'Uplift base case'*: When the initial harvest level in the base case projection was increased by one million cubic metres to 3.34 million cubic metres per year for 10 years (still no MPB presence assumed) the projected reduction to the same long-term level as in the base case occurred three decades earlier (decade 16).
3. *'Beetle base case'* When the effect of the MPB was accounted for in the base case with the affected area increasing at the recent average rate of 44 percent but with no increase in the initial harvest level, the current AAC of 2.34 million cubic metres per year could be maintained for five decades only, after which it fell to 2 million cubic metres per year for 9 decades, before rising to the original long-term harvest level of 2.2 million cubic metres per year.
4. *'Best case'*: In this projection the initial harvest level was increased by one million cubic metres for ten years and it was assumed that cold weather would prevent the MPB from spreading further than the 39 000 hectares expected to be affected by the end of 2001. This projection was identical to the '*uplift base case*', except that the drop to the long-term level occurred after 14 instead of 16 decades.
5. *'Moderate case'*: In this projection the initial harvest level was increased by one million cubic metres for ten years, and it was assumed that the area affected by the MPB would expand at a rate of 35 percent annually, reduced from the past six-year average rate of 44 percent. In this projection, after ten years at 3.34 million cubic metres per year, the harvest level declined to 2.34 million (the current AAC) for ten years, then to a mid-term level of 2.12 million cubic metres, before increasing as before

in decade 14 to the long-term level of 2.2 million (note the variance here from the published analysis report which identified this transition at decade 16.)

6. *'Worst case':* In this projection the initial harvest level was increased by one million cubic metres for ten years, and it was assumed that the area affected by the MPB would continue to expand at the past six-year average rate of 44 percent annually. This projection was identical to the '*moderate case*' except that the mid-term level was lower at 2.08 million cubic metres (note the variance from the 2.07 figure in the published analysis).

7. *'Three-million uplift'*: In this projection the initial harvest level was increased by *three million* cubic metres for ten years, and it was assumed that the area affected by the MPB would continue to expand at the past six-year average rate of 44 percent annually. This projection was identical to the '*moderate case*' and the *'worst case'* except that the mid-term level was lower at 2.00 million cubic metres compared to 2.08 million.

8. *'Four*-million uplift': In this projection the initial harvest level was increased by *four million* cubic metres for ten years, and it was assumed that the area affected by the MPB would continue to expand at the past six-year average rate of 44 percent annually. This projection was essentially identical to the '*moderate case*' and the *'worst case'* except that the mid-term level was slightly lower at 1.98 million cubic metres.

In assessing which of these alternative projections represents the timber supply in the Quesnel TSA today most reliably with respect to all aspects of current management, including the CCLUP and the need for control and salvage harvesting related to the MPB infestation, I note the following.

All projections account for the requirements of the CCLUP noted and discussed in other sections of this document.

Forecasts Nos. 1 and 2 make no accounting for the effect of the MPB on the timber supply and therefore cannot be considered realistic.

In projection No. 3, the MPB proceeds unchecked by any immediate increase in the harvest level. Data supporting this projection indicate that this results over the planning horizon in an estimated total loss of merchantable volume to the MPB in 'Beetle Kill Residual Areas' and 'Unsalvaged Beetle Areas' of over 40 million cubic metres on over 218 000 hectares of killed timber. This would be an undesirable outcome with respect to multiple forest management objectives, including habitat requirements for species requiring mature forest.

Projections Nos. 4, 5 and 6 all incorporate an immediate one-million-cubic-metre harvest level increase to deal with the MPB, and vary only in their outcomes in dependence on the spread of the MPB. In No. 6, the 'worst case' forecast, in comparison to No. 3, the total volume lost to the MPB is reduced to over 34 million cubic metres on just under 185 000 hectares.

Projections 7 and 8 show the rather surprising result that the timber supply in the TSA is sufficiently stable to support immediate increases of three and four million cubic metres per year for ten years with only minor consequences in the mid term and no effect on the long-term harvest level. The respective losses to the MPB for the three- and four-million uplifts would be 23 million cubic metres on 117 000 hectares and 17.7 million cubic metres on 88 000 hectares.

From these considerations I have dismissed projections 1, 2 and three as unrealistic or undesirable. Nos. 7 and 8 result in the least residual loss of timber and damage to the landscape, but in my view these advantages are currently outweighed by other difficulties. From discussions with the Cariboo Forest Regional Manager and the Quesnel Forest District Manager I am assured that harvest level increases of these dimensions would not be manageable within the existing capabilities either of local and regional resources with respect to staffing for planning and administering the cut or to the ability of existing facilities to process the very large (almost triple) increase in the volume of timber harvested.

I have therefore concluded that while an increase in the harvest level is necessary to avoid the adverse consequences of the MPB infestation that would ensue from continuing at the current harvest level, as projected in projection No. 3, increases of the magnitude in Nos. 7 and 8 are not currently manageable.

The size of the one-million-cubic-metre increase incorporated in projections Nos. 4, 5 and 6 has not been predicated on a specific biological outcome with respect to the MPB, but regional and district BCFS staff have indicated that in their opinions this is the maximum increase in harvest rate that could be administered, managed and processed at existing resource levels. This level therefore provides the maximum manageable level of control of the rate of spread of the MPB and of the rate of salvage harvest. The presence of the MPB in the TSA means that a reduction in the mid-term harvest level below that projected in the base case is inevitable under all forecasts. Since the one-million increase can be maintained for ten years with only manageable consequences to the projected mid-term supply, and will result in significant reductions in wasted timber, I am satisfied that this is an acceptable and desirable course of action for consideration at this time for contending with the effects of the MPB.

Moreover, the analysis in projections Nos. 7 and 8 shows that if a need for a further increases is demonstrated, and sufficient resources can be made available for their management, administration and processing, these temporary increases could also be managed within acceptable projected harvest flows.

Projection No. 6, the 'worst case' was used as the basis for a number of sensitivity analyses showing the results of changing various inputs as described throughout this rationale document. As noted in 'Impediments to prompt regeneration', the analysis of a 15-year total regeneration delay for timber killed by MPB showed 50 000 cubic metres per year less timber available in the mid term. In view of the likely impediments to regeneration in stands on 'Unsalvaged Beetle Areas', I consider that the sensitivity analysis incorporating the 15-year regeneration delay to be a more reasonable reflection of the likely performance in these stands than the assumption in the 'worst case' forecast that such unsalvaged areas will be regenerated after five years with no further regeneration delay.

Another sensitivity analysis applied to the 'worst case' projection showed the result of increasing the assumed recovery rate in salvaged stands from 50 percent to 60 percent. In this projection, the mid-term level increased slightly from 2.08 million to 2.1 million cubic metres per year.

Another sensitivity analysis showed the effect of reducing the merchantability criterion from 150 to 100 cubic metres per hectare. This also resulted in a slight increase in the mid-term level from 2.08 million to 2.1 million cubic metres per year.

These two sensitivity analyses are useful in identifying the implications for timber supply of operational decisions that may be made in MPB management.

For the reasons discussed in this section, I have chosen No. 6, the 'worst case' projection, and the related sensitivity analyses, as a reliable basis for many of my considerations in this determination. In particular, as noted in 'Impediments to prompt regeneration' and 'Reasons for Decision', in respect of the likelihood of an extension to a 15-year regeneration delay in unsalvaged stands, I have accounted for a reduction of 50 000 cubic metres per year in the mid-term harvest level projected in the 'worst case' forecast. I also note that the projection accounted for the current rate of spread of the MPB, but made no accounting for a possible recurrence of an epidemic beetle infestation in the future. A further infestation could again reduce the timber supply, for the same reasons as in the current infestation. Given the current preponderance of older wood in the TSA, it is likely that future losses would be less extensive than those associated with the current infestation unless MPB activity concludes earlier than currently expected, leaving more of the older wood still susceptible to future attack. In respect of this possibility, in my determination I have accounted for an unquantified overestimation of the projected timber supply in the medium and long terms.

In view of the uncertainty in predicting the outcome of the MPB's activities, I am reassured to know that if very high levels of damage continue to occur, the feasibility of additional short term increases in harvest levels has been demonstrated with respect to the integrity of the harvest flow (in projections 7 and 8). However, the logistics of implementing and marketing such large increases are also uncertain, as are the outcomes of harvest level increases if the MPB returns after, for instance, a fifteen-year interval. These and associated implications are properly left for consideration in future AAC determinations.

In conclusion, in my determination of this AAC for the Quesnel TSA I have relied extensively, and have placed considerable weight on, my considerations and conclusions in this section, as discussed further in 'Reasons for Decision'.

Reasons for Decision

In reaching my AAC determination for the Quesnel TSA, I have considered all of the factors presented above, and I have reasoned as follows.

It is my view, and that of the Cariboo Forest Regional Manager, the Quesnel Forest District Manager, BCFS entomologists and planning and other staff, that the potential for the current epidemic MPB infestation to compromise the achievement of a range of forest management objectives in the TSA is related to the eventual overall extent of the damage that the beetle is able to incur before its population collapses, either from a weather event (extreme cold at a critical time) or when all susceptible host stands have been attacked. For that reason, the curtailment of the spread of the epidemic infestation, and the salvage of large and growing areas of damaged timber—before serious losses occur to both commercial value and government revenues—have become urgent, complementary priorities in forest management objectives for the TSA.

Experience has shown, as documented by Forestry Canada (see Appendix 3) that at the current epidemic stage of the infestation, the only practical control measure for bringing about the required curtailment is 'clearcutting well beyond the areas having red trees in order to remove trees containing beetles'. The application of 85 percent of the current AAC to the harvesting of attacked stands has not kept pace with the beetle in recent years, as a result of which about six million cubic metres of affected timber now stand dead or dying on the TSA landscape. The determination of the appropriateness of a significant increase in the harvest level—to remove the affected timber, to eliminate beetle brood trees, to capture otherwise lost value, and to avoid extensive regeneration delays from residual unsalvaged areas—is therefore now urgent. This urgency is increased in view of the large proportion of mature and healthy but susceptible lodgepole pine stands still remaining on the timber harvesting land base, and in view of the recent high average rate of increase (roughly 44 percent over the past six years) in the net area affected annually by the infestation. In response to this urgency, the process leading to this AAC determination has been carried out in an expedited way that has included abbreviation of some components of the normal timber supply review process, as discussed earlier in this document under 'Expedited process for an urgent AAC determination to address the infestation'.

This abbreviation of some parts of the process leading up to my determination, however, has not constrained either the scope or the rigour of my review of all the factors required to be considered in an AAC determination under section 8 of the *Forest Act*. Staff of the Forest Service and MELP have contributed considerable overtime ensuring a sustained high quality of investigation and presentation in all the information and analysis which I have considered in making this determination. From my careful review of the information before me in this determination, I am satisfied that the full range of considerations required to be addressed has been comprehensively presented and assessed, and that this has allowed me, in this otherwise extraordinary determination, to proceed in an unhindered way to consider, reason among and document all the relevant factors that I would normally consider in any 'ordinary' AAC determination for a TSA. Accordingly, my 'Reasons for Decision' are presented in the same manner as in any other determination, acknowledging the substantial focus on the urgency to consider the abnormal MPB infestation as provided under section 8(8)(e) of the *Forest Act*.

In deciding among a number of alternative harvest forecast projections for the TSA, in the section 'Epidemic mountain pine beetle infestation' I have given my reasons for accepting the one-million-cubic-metre increase as incorporated in projections Nos. 4, 5 and 6 as a suitable reference on which to base my considerations for this determination. I have accepted that this contemplated level of increase in the harvest is not predicated on a specific biological outcome with respect to the MPB—which is unpredictable in many respects—and that regional and district BCFS staff consider this to be the maximum increase in harvest rate that could be administered, managed and processed at existing resource levels. This level therefore provides the maximum currently manageable level of control of the rate of spread of the MPB, the maximum currently manageable rate of salvage harvest, and hence the maximum practicable curtailment of the ultimate extent of the compromise incurred by the MPB in a range of forest management objectives in the TSA.

I noted also in that section that the presence of the MPB in the TSA means that a reduction in the mid-term harvest level below that projected in the base case is inevitable under all the reviewed forecasts (discounting the implications of site index adjustments and the other influential factors listed and discussed below). Since the one-million increase can be maintained for ten years with only manageable consequences to the projected mid-term supply, and will result in significant reductions in wasted timber and lost habitat, I am satisfied that this is an acceptable and desirable course of action for consideration at this time for contending with the effects of the MPB. For these reasons, I have considered projection No. 6, the 'worst-case' scenario, together with associated sensitivity analyses, in which the MPB is assumed to continue to spread and affect a new net area increased each year by 44 percent, as a suitable basis for examining the range of considerations required by section 8 of the *Forest Act*. However, the appropriateness of the use of this scenario in my considerations is not dependent on the actual rate of spread of the beetle in the future, but on the suitability of the contemplated increase as a means of managing already incurred damage, while meeting the range of forest management objectives in the TSA and reducing as far as possible the extent of further damage.

My considerations in determinations under section 8 typically identify various factors which, considered separately, indicate that the timber supply may actually be either greater or less than that projected in the reference or 'base case' forecast—in this case the 'worst-case' forecast. Some of these factors can be quantified and their impacts assessed with some reliability. Others may influence timber supply by introducing an element of risk or uncertainty to the decision, but cannot be reliably quantified at the time of determination. These latter factors are accounted for in determinations in more general terms.

The following factors have been identified under the noted sections in my considerations for the Quesnel TSA as reasons why the timber supply projected in the 'worst case' forecast may have been underestimated to degrees that may be quantified:

- *Non-merchantable and residual forest types:* The inadvertent removal of 2033 hectares of cedar forest types in deriving the timber harvesting land base resulted in a small underestimation in the projected timber supply in all time periods.
- *Woodlot licences:* The incorrect assignment of 6825 hectares of woodlot ownerships resulted in an underestimation by that amount in the timber harvesting land base.
- *Volume estimates for managed regenerated stands:* The use of select pine seed, which results in a volume gain that was not modelled in the analysis, has led to an approximately 0.2 percent underestimation in pine volumes in regenerated stands, which is applicable to the mid and long-terms only.

The following factors have been identified in my considerations as reasons why the timber supply projected in the reference forecast may have been underestimated to a degree that may not be readily quantified with accuracy:

- *Estimates for site productivity*: The application of adjustments based on 'SIBEC' values to site indices for stands younger than 41 years and stands older than 140 years after harvest indicates the likelihood of an unquantified but substantial underestimation in the projected mid-and-long-term timber supply.

- *Deciduous forest types*: The conversion by natural succession of some deciduous stands to coniferous stands implies an unquantifiable underestimation in the coniferous component of the timber supply in the mid and long terms.

- *Cutblock adjacency, forest cover and green-up*: The waiving of adjacency requirements in the short term to accomplish MPB management will lead to less constrained planning of cutblocks in the mid term and thus to a currently unquantifiable increase in the mid-term supply.

I have identified the following factors as indicative of potential overestimations in the timber supply to degrees that may be quantified with some reliability:

- *Alienations from Provincial Forest*: About 508 hectares of land formerly lying in the timber harvesting land base and now removed for other land uses were not deducted in deriving the timber harvesting land base, resulting in an overestimation in the timber supply by this very small amount, affecting the mid and long terms.
- *Volume estimates for existing natural stands*: The June 1999 inventory audit suggested that the timber volumes in the existing mature stands component of the inventory may be overestimated by approximately 11 percent, implying a medium-term harvest level 120 000 cubic metres per year below the projected 'worst case' mid-term level.
- *Lower Blackwater LRUP*: In deriving the timber harvesting land base for the current analysis deductions accounting for Zone 1 of the LRUP and for the portions of Alexander Mackenzie Heritage Trail in the Quesnel TSA were inadvertently omitted, resulting in an overstatement of the timber harvesting land base by a net area of approximately 5300 hectares.

I have identified the following factors as indicative of a potential overestimation of the timber supply to a degree that currently may not be quantified with accuracy:

- *Impediments to prompt regeneration*: The probability of a fifteen-year, rather than the modelled five-year regeneration delay in 'Unsalvaged Beetle Areas', incurs a moderate likelihood of a reduction of up to 50 000 cubic metres per year in the harvest level projected for the mid term
- *Aging of the forest cover outside the timber harvesting land base*: The lack of allowance in the analysis for the aging of the forest outside the timber harvesting land base implies an unquantified, moderate overestimation of the projected mid- and long-term timber supplies.
- *Possible Future MPB attack*: The absence of accounting in the analysis for a possible future recurrence of an epidemic beetle infestation implies an unquantified overestimation of the projected timber supply in the medium and long terms.
- *Deciduous forest types*: The conversion by natural succession of some deciduous stands to coniferous implies an unquantified overestimation in the deciduous component of the timber supply.

From reviewing all of my considerations documented above, including the above list of factors identifying the under- and overestimations in the projected timber supply, I have reasoned and concluded as follows.

It is helpful to review the 'quantified' factors arithmetically in a general sense, without contrived precision, as suggesting underestimations in the analyzed timber harvesting land base totalling roughly 11000 hectares (including an approximate conversion of the use of select seed into an 'area-based' impact) and overestimations totalling about 5700 hectares, for a net underestimation in the order of 5300 hectares. In a timber harvesting land base of over one million hectares this is not a consequential adjustment, and in any case is it is likely to be at least partially offset by the unquantified overestimation in the timber supply implied by the conversion of deciduous stands to coniferous stands.

In the mid term, the timber supply is underestimated on two accounts, first due to the implications of waiving adjacency to manage the MPB in the short term, and second, due to the implied substantial increase from the suggested site index adjustments, which indicate the possibility of maintaining the current AAC of 2.34 million cubic metres for 250 years, and an even higher projected long-term harvest level. On the other hand, the extended regeneration delay associated with residual, unsalvaged stands damaged by the MPB indicates the mid-term level may be constrained by as much as 50 000 cubic metres more than projected, and the overestimation of mature volumes indicated in the inventory audit shows a mid-term overestimation of up to 120 000 cubic metres. While the exact nature of the combined mid-term result of these several substantial factors is difficult to predict with accuracy, it is apparent that there will be some degree of mutual offset and that the resulting mid-term level, though uncertain, will be not dramatically different from the range indicated by the sensitivity analyses. In the worst case, the projections show a robustness that indicates the feasibility of substantial short-term increases without severe mid-term effects.

Whether, when and to what extent an MPB infestation will reoccur in the TSA in future cannot be predicted. However, because extensive areas of young pine regenerating after the current infestation will not be susceptible again until maturity, unless a weather event concludes the current outbreak rapidly, leaving much of the current mature pine intact, it is reasonable to conclude that the most serious effects could be primarily in the longer term. This is also when the unaccounted-for aging of the non-contributing forest will tend to depress the supply. But the site index sensitivity analysis shows a probable increase in the long term level, which is therefore likely to have been reasonably well projected overall.

In context of the current catastrophic MPB infestation it is not useful to attempt to place any finer point on these generalized considerations, beyond the conclusion that nothing in the considerations I have reviewed indicates that the forecasts presented cannot be relied on as providing a reasonable understanding of the potential effects of the MPB, and its management, on the projected timber supply in the TSA.

In accordance with these projections I therefore conclude as follows. To this point, assuming a reasonable average of 250 cubic metres per hectare, the roughly 24 000 hectares of timber on the land base affected by the MPB represent 6 million cubic metres of dead timber. Given recent conditions, more will continue to die; after the most recent spread, the outstanding affected area in the fall of 2001 is expected to be 39 000 hectares, or nearly ten million cubic metres.

These volumes of timber already standing dead and dying on the landscape are far in excess of what can be managed under the current AAC during the short remaining commercial life of such stands. The proposed one-million-cubic-metre increase would

remove this management constraint, allowing for greater salvage of the current and immediately expected dead timber over the term of the new AAC. It would also help, by the simultaneous removal of 'green-attack' stands, to contain the overall influence of the MPB and its cumulative impact on other forest management objectives in the TSA. Because the analyses have shown the feasibility of this increase as part of a sound strategic approach to the timber supply in the TSA that includes consistency with the biodiversity objectives of the CCLUP, it is my determination that an increase of one million cubic metres at this time is both possible and necessary.

If the MPB continues to expand, the projections show the feasibility of even larger harvest increases. On the other hand, if the MPB undergoes a population crash, the entire increase may not be required for the duration of the effective term of the AAC. For both of these reasons, I will request that BCFS staff monitor and keep me apprised of the condition of the infestation, on the understanding that, as and when appropriate, I may revisit this determination at a date earlier than required by statute, for the purpose of determining either a further increase, or a reduction, as necessary.

With respect to that portion of the harvest attributable to problem forest types, as I have noted in – *problem forest types*, I do not consider it appropriate to expand the use of PFT volumes while a substantial increase in the overall harvest level is being contemplated, particularly when attendant risks to other forest values must be carefully managed. By not increasing the PFT harvest rate now, more of these stands will be present later to offset any mid-term risk. I have therefore concluded at this time to maintain the allowable harvest attributable to PFTs at the current level of 300 000 cubic metres per year.

Regarding the portion of the harvest attributable to deciduous forest types, I have noted the analysis includes an unquantified underestimation due to their conversion to coniferous stands. I have also noted that deciduous species—which are not targeted by the MPB, but which are in many cases interspersed with pine in areas of severest attack—are potentially capable of making an important contribution to the provision of forest cover for biodiversity purposes following the required harvest of large areas of infested pine particularly in mixed stands. For these reasons I have concluded to reduce the currently available harvest of deciduous species to 20 000 cubic metres per year.

Determination

Having considered and reviewed all the factors as documented above, including the risks and uncertainties of the information provided, it is my determination that a timber harvest level that (i) accommodates objectives for all forest resources during the next five years, that (ii) reflects current management practices as well as the socio-economic objectives of the Crown, and (iii) provides for the timely salvage of timber damaged by the MPB while (iv) diminishing the overall extent of future damage by the MPB, can be best achieved in the Quesnel TSA at this time by establishing an AAC of 3 248 000 cubic metres.

Within this total AAC of 3 248 000 cubic metres, a partition of 300 000 cubic metres is specified as attributable to problem forest types as defined by the Quesnel Forest District Manager.

Also within this total AAC of 3 248 000 cubic metres, a partition of 20 000 cubic metres is specified as attributable to deciduous forest types.

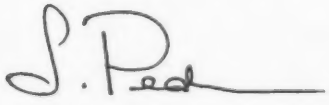
This AAC volume excludes all volumes in issued woodlot licences. This new AAC becomes effective July 1st, 2001, and will remain in effect until another new AAC is determined, which must take place within five years of the present determination.

The following observation is important to, and forms an integral part of this determination. Staff of the BCFS will monitor and apprise the chief forester of the condition of the MPB infestation, on the understanding that, if and when required, this determination may be revisited at a date earlier than required by statute.

Implementation

In the period following this decision and leading to the subsequent determination, I encourage BCFS staff to undertake the tasks and studies noted below that I have also mentioned in the appropriate sections of this rationale document. I recognize that the ability of staff to undertake these projects is dependent on available staff resource time and funding. These projects are, however, important in helping to reduce the risk and uncertainty associated with key factors that affect the timber supply in the TSA.

- Review operability assumptions, particularly respecting the presence of steep slopes, for clarification in the next analysis.
- Initiate work in the district to confirm site productivity, in view of the high sensitivity of the mid-term timber supply to increases in site index.
- Monitor mule deer and caribou habitat management so that any changes in practices can be incorporated into the next analysis.
- Monitor the MPB with respect to (i) the ongoing achievement of CCLUP objectives and (ii) the likely need for continued elevated harvest levels.
- Complete landscape unit objectives.
- Verify stand age/seral stage classes in landscape units/BEC areas with identified concerns.
- Assess the potential contribution of NSR stands to the timber supply.



Larry Pedersen
Chief Forester

June 12, 2001

Appendix 1: Section 8 of the *Forest Act*

Section 8 of the Forest Act, Revised Statutes of British Columbia 1999, reads as follows:

Allowable annual cut

8. (1) The chief forester must determine an allowable annual cut at least once every 5 years after the date of the last determination, for

(a) the Crown land in each timber supply area, excluding tree farm licence areas, community forest areas and woodlot licence areas, and

(b) each tree farm licence area.

(2) If the minister

(a) makes an order under section 7 (b) respecting a timber supply area, or

(b) amends or enters into a tree farm licence to accomplish the result set out under section 39 (1) (a) to (d),

the chief forester must make an allowable annual cut determination under subsection (1) for the timber supply area or tree farm licence area

(c) within 5 years after the order under paragraph (a) or the amendment or entering into under paragraph (b), and

(d) after the determination under paragraph (c), at least once every 5 years after the date of the last determination.

(3) If

(a) the allowable annual cut for the tree farm licence area is reduced under section 9 (3), and

(b) the chief forester subsequently determines, under subsection (1) of this section, the allowable annual cut for the tree farm licence area,

the chief forester must determine an allowable annual cut at least once every 5 years from the date the allowable annual cut under subsection (1) of this section is effective under section 9 (6).

(4) If the allowable annual cut for the tree farm licence area is reduced under section 9 (3), the chief forester is not required to make the determination under subsection (1) of this section at the times set out in subsection (1) or (2) (c) or (d), but must make that determination within one year after the chief forester determines that the holder is in compliance with section 9 (2).

(5) In determining an allowable annual cut under subsection (1) the chief forester may specify portions of the allowable annual cut attributable to

(a) different types of timber and terrain in different parts of Crown land within a timber supply area or tree farm licence area, and

(b) different types of timber and terrain in different parts of private land within a tree farm licence area.

(c) [Repealed 1999-10-1.]

(6) The regional manager or district manager must determine a volume of timber to be harvested from each woodlot licence area during each year or other period of the term of the woodlot licence, according to the licence.

(7) The regional manager or the regional manager's designate must determine a volume of timber to be harvested from each community forest agreement area during each year or other period, in accordance with

(a) the community forest agreement, and

(b) any directions of the chief forester.

(8) In determining an allowable annual cut under subsection (1) the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

(a) the rate of timber production that may be sustained on the area, taking into account

(i) the composition of the forest and its expected rate of growth on the area,

(ii) the expected time that it will take the forest to become re-established on the area following denudation,

(iii) silviculture treatments to be applied to the area,

(iv) the standard of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area,

(v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production, and

(vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber,

(b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area,

(c) the nature, production capabilities and timber requirements of established and proposed timber processing facilities,

(d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia, and

(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

Appendix 2: Section 4 of the *Ministry of Forests Act*

Section 4 of the *Ministry of Forests Act* (consolidated 1988) reads as follows:

Purposes and functions of ministry

4. The purposes and functions of the ministry are, under the direction of the minister, to

(a) encourage maximum productivity of the forest and range resources in British Columbia;

(b) manage, protect and conserve the forest and range resources of the government, having regard to the immediate and long term economic and social benefits they may confer on British Columbia;

(c) plan the use of the forest and range resources of the government, so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural

resource values are coordinated and integrated, in consultation and cooperation with other ministries and agencies of the government and with the private sector;

(d) encourage a vigorous, efficient and world competitive timber processing industry in British Columbia; and

(a) assert the financial interest of the government in its forest and range resources in a systematic and equitable manner.

Appendix 3: Extract from Unger, L. 1993. Mountain Pine Beetle. Forestry Canada, Forest Insect and Disease Survey, Forest Pest Leaflet No. 76, 7p

Introduction

The mountain pine beetle, *Dendroctonus ponderosa*, a native pest, is the most serious insect enemy of mature pines in western Canada. In British Columbia, major outbreaks occurred in all areas with a significant pine component, except for the northern quarter of the province. Since the first recorded infestations in 1913, in the Okanagan and Merritt areas, major infestations have occurred in Kootenay National Park and the Chilcotin Plateau in the 1930s, on Vancouver Island during the 1940-50s, near Takla and Babine lakes in the 1950s, and through much of the southern interior, Chilcotin Plateau and the Skeena and Nass river areas in the late 1970s and 1980s. Well over 500 million trees were killed by the mountain pine beetle during the past 80 years.

Outbreaks generally last 8-10 years and severely deplete the pine component of forest stands; trees with a diameter greater than 25 cm are particularly susceptible. Extensive mountain pine beetle infestations hasten forest succession, change the age and diameter distribution of the pine components of the forest, and reduce aesthetic values. Infestations can also cause marketing and operational problems and environmental concerns when large volumes of dead pine are harvested either for control or salvage purposes.

Large reserves of mature pine forest are always at risk in areas climatically favorable for the beetle. Good access to susceptible forests is needed so that preventative measures can be taken and so that infested stands can be quickly treated.

Hosts

The mountain pine beetle is distributed throughout British Columbia north to 56ø latitude. Infestations have been recorded from sea level to the highest elevations where the host species grow. Native hosts include lodgepole pine (Pinus contorta), ponderosa pine (*Pinus ponderosae*), whitebark pine (Pinus albicaulis), and limber pine (Pinus flexilis). Some exotic pines may also be attacked. Occasionally non-host trees such as Engelmann spruce (Picea engelmannil) are attacked, but beetle populations do not persist in these occasional hosts.

Description and Life History

Adults are cylindrical, 3.7 to 7.5 mm long; teneral adults are light creamy-tan in color, changing to black when mature.

Eggs are pearly white, about 1 mm in size, and are laid singly in niches on both sides of the parent gallery.

Larvae are white legless grubs with red-brown heads, about 5 mm long in the fourth (final) instar.

Pupae are white at first, changing to light brown, about 5 mm long, with the external characteristics of the adult beetle visible.

The life cycle of the mountain pine beetle varies considerably. The normal cycle takes one year to complete; however, during warmer than average summers, parent adults may re-emerge and establish a second brood in the same year. Conversely, in cooler summers or at higher elevations, broods may require two years to mature. These variations in the life cycle may result in rapid increases in population levels, or conversely, sharp population decreases.

Beetle flights normally occur throughout July and into August, and generally peak in late July. Upon locating a suitable host, females bore through the bark to the phloem and cambium region, and start construction of the egg gallery, usually on the lower 5 m of the bole. The first females that attack a tree emit an aggregating pheromone which attracts mainly males. The males in turn emit pheromones attracting additional females. This leads to a mass attack which overcomes the tree's resistance. The egg galleries are usually about 30 cm long but occasionally they may reach 90 cm. They extend upward parallel to the grain and usually score both bark and sapwood. Eggs are laid in individual niches 0.5 cm apart along both sides of the gallery, and are tightly packed with frass. Eggs generally hatch in 10-14 days. Larvae feed on the phloem in individual mines extending, under uncrowded conditions, about 13 cm at right angles to the egg gallery. Broods overwinter mainly as larvae. Larval development is completed in early summer of the following year. When larvae mature, they excavate an oval chamber in which they turn into pupae. Following a short pupation period, pupae become adults. Newly formed adults, called teneral adults, spend a brief period feeding under the bark before the mature adults emerge by boring through the bark and fly to living trees to commence another cycle.

Fungi, yeasts, bacteria and other microorganisms associated with the beetle are carried by them into the tree. Some of these microorganisms are pathogenic to the tree or the bark beetle, while others are beneficial to the beetle. Fungi, which are commonly introduced by the beetle and produce blue stain in the sapwood, commence growth in the phloem and xylem soon after the beetles start their galleries. As the fungi become established they interrupt the flow of water to the crown and reduce the tree's pitch flow, which is its main defense mechanism against beetle attack. Successfully established bluestain fungi will also retain moisture in the sapwood and prevent excessive dehydration of the phloem, which is essential for brood survival. The combined action of the beetle and fungi kills the tree. Teneral adults need to feed on fungal fruiting bodies to mature, and specialized mouth parts of the beetle ensure that emerging beetles carry fungi to living trees.

Damage and Detection

Infested trees can be detected through crown and external symptoms, but the mountain pine beetle can only be positively identified (and the success of an attack can only be positively determined) by looking under the bark.

External evidence of beetle infestation on the bole usually consists of (i) pitch tubes on the stem where beetles have entered the tree, and (ii) boring dust at the base of the tree.

The color of the pitch tube often indicates the success or failure of the beetle attack. Scattered pitch tubes that are whitish in color indicate that the tree has repelled or killed the beetle by pitch exudation. In contrast, numerous reddish brown pitch tubes usually indicate that the attack has succeeded. However, pitch tubes remain pliable for several years, so soft pitch tubes do not necessarily mean that a tree is currently under attack. Pitch exudation may not occur during periods of drought or when trees are stressed due to root rot or other reasons. However, trees that have been recently and successfully infested will have dry boring dust in bark crevices and at the base of the tree. The boring dust is produced only during the initial stage of gallery construction and, depending on weather conditions, it may rapidly become inconspicuous. Woodpecker activity will often be greatly increased in infested areas, and woodpeckers will leave numerous pecking holes and may remove sections of the bark.

Characteristic symptoms under the bark include a vertical parent gallery with a slight J-like hook at the bottom and evenly spaced larval galleries extending at right angles from the parent gallery. Galleries are tightly packed with sawdust. The phloem will be dried out and brownish, and the sapwood will usually be stained a bluish color due to the fungi associated with the beetle.

Tree foliage begins to dry out as soon as the conduction of water up the tree is interrupted. As a result, the color of the foliage on infested trees gradually changes from bright to dull green. This early symptom in the lower crown will often become visible 2-3 months after attack. However, more distinct color changes occur during the onset of the growing season the spring following attack. Most lodgepole pine change from yellowish green to an orangey red by July and rusty brown by late summer. At this time most of the beetles will have left the tree. Other tree species display varying color patterns: ponderosa pine seldom turns red but develops more of a straw color, while white pine tends to become bright red. With time, retained foliage color becomes more dull, and most of the foliage drops in 2-3 years; this will vary from species to species and with weather conditions. These rapid and distinct color changes are used to schedule aerial mapping of recently attacked trees.

Beetles Associated with Mountain

A number of secondary beetles are associated with mountain pine beetle and at times these secondary beetles make diagnosis of the causal agent of tree mortality difficult. Secondary bark beetles generally do not successfully establish in healthy, vigorous trees.

Several engraver beetles (Ips pini, I. latidens and I. mexicanus) attack fresh windfelled trees, logging residue, and uninfested portions of the boles of trees killed by mountain pine beetle, as well as trees of low vigor caused by root rots, stem diseases, defoliation, etc. Occasionally, however, they may become destructive in apparently healthy trees, but infestations are usually short. Since a portion of the population overwinters in the duff, extreme cold winter temperatures, which can devastate mountain pine beetle population, are much less destructive to the Ips beetles. As a result, these engraver beetles, which increased along with the mountain pine beetle population, may continue at epidemic numbers for 1 or 2 years.

Ambrosia beetles (Trypodendron spp. and Gnathotrichus sp.) are wood or pinhole borers that infest recently killed trees, fresh slash, and downed material. Infestation by these beetles can be recognized by the small piles of white boring dust surrounding the points of entry into the wood or around the lower portion of the stem.

The red turpentine beetle (Dendroctonus valens) bores under bark near the root crown and produces large reddish brown pitch tubes around the base of the bole. This is the largest of the Dendroctonus species: larvae are up to 12 mm long, and the reddish colored adults generally are between 5 and 9 mm.

The lodgepole pine beetle (Dendroctonus murrayanae) attacks the lower metre of the stem forming an irregular vertical gallery with eggs laid in groups of 20-50 along both sides of the gallery. Larvae feed gregariously. Larvae and the reddish brown adults are only slightly smaller than the same stages of the mountain pine beetle.

Sour sap bark beetles (Hylurgops and Hylastes spp.) usually attack the stem near and below duff level. Adults are black or reddish, but tend to be shorter (3-6 mm) and more slender than mountain pine beetle.

Management

Prevention

The first step in prevention of mountain pine beetle outbreaks is to prioritize stands for preventive maintenance. To this end, risk and susceptibility rating systems have been developed combining the stand parameters associated with beetle infestations and the beetle pressure on a stand.

Susceptibility increases in stands (i) with trees over 60 years of age (moderate susceptibility) and with trees over 80 years of age (high susceptibility), (ii) with trees over 25 cm in diameter, (iii) with a high pine component, (iv) with a density between 750 and 1500 trees/ha, and (v) at lower altitudes and latitudes. The risk of an infestation developing within a stand is based on its distance to the nearest infestation and its level of current attack. For example, stands within 3 km of an active infestation and with more than 100 trees already attacked would be considered at risk. Risk factors can change dramatically within a year, while stand susceptibility changes gradually over a number of years.

Silvicultural treatments which help to reduce stand susceptibility include (i) reducing stand density to below 500 trees/ha, (ii) establishing an age and tree size mosaic within a stand or drainage, (iii) implementing a shorter rotation period, and (iv) establishing a species mix within a stand. The effectiveness of these measures may be reduced considerably in the presence of high beetle pressure, however.

Aerial surveillance,especially of moderate to high risk stands, will detect the initial phases of beetle invasion and allow for the early implementation of effective control measures.

Ground surveys should be conducted when pockets of discolored trees first appear in a stand to verify the causal agent and the status of the brood.

Applied Control

A variety of applied controls can be utilized, depending upon the extent of the beetle problem. In conjunction with controls, synthetic aggregating pheromones can be used effectively to concentrate beetle attack. This greatly improves the efficiency in locating newly attacked trees for follow-up treatment actions, or for containing most of an attack within a given harvesting area. Under specific conditions, mass trapping of beetles may prevent small local beetle populations from increasing or it may even reduce these populations to endemic levels. However, the effect of trapping becomes negligible when the beetle populations reach epidemic proportions.

During the initial phases of an infestation when only small infestation pockets are present, individual trees containing beetle brood can be treated by felling and burning, applying an appropriate silvicide to infested trees within 24 days of attack, application of a registered insecticide to the bole of infested trees just prior to beetle emergence, and the use of pheromone-baited, lethal (insecticide-treated) trap trees. Permits are required for such work in B.C. forests.

At intermediate infestation levels (up to about 100 trees per patch), small-patch logging can be used if good access is in place, and if beetle attack is concentrated naturally or through the use of pheromone baits. Beyond the intermediate stage, and when infestations exceed 10 ha, control becomes increasingly more difficult. In larger infestations the rate and range of beetle dispersion increases and any effective control program will require very extensive ground surveys to locate the green, newly attacked trees. Consequently, the only practical control measure at this stage is clearcutting well beyond the areas having red trees in order to remove trees containing beetles.

Natural Control

Resin flow and predation and parasitism are relatively ineffective in large infestations, but can be important in maintaining populations at endemic levels.

Resin flow is the tree's active defense mechanism against beetle invasion. It is effective in flushing out beetles (pitchout) or destroying eggs only when attack density is low, or when a high attack level is spread over a number of days. During periods of tree stress, such as drought, resin flow may be greatly reduced.

Predation and parasitism play a significant role in beetle population dynamics. Woodpeckers are the most conspicuous predators as they remove bark in search of beetle brood, in the process of bark removal they also reduce the survival rate of the remaining insects due to desiccation.

Perching birds also consume large quantities of flying beetles. Some of the more commonly encountered insect predators include the clerid (checkered) beetles, and Diptera (various true fly species). Several species of wasps occasionally kill large numbers of mountain pine beetles.

Temperature can be an important factor in determining population levels during the course of an infestation. Optimum under-the-bark temperatures for brood development are between 20 and 26øC. Cool summers may delay beetle flight and subsequently slow brood development, which can affect overwintering brood survival. Early fall temperatures of -18ø will kill brood, while even less severe temperatures will kill eggs and larvae in the first three larval instars. The most cold-hardy stage, late-instar larvae, when conditioned for cold temperatures, cannot withstand temperatures below -37ø; temperatures of -27ø persisting for several days will kill a large portion of the population. Once the maturing larvae have resumed feeding in the spring they again become very susceptible to freezing temperatures. Since the impact of low temperatures is moderated by tree size, bark thickness and snow insulation, the duration of the cold period and snow pack is a critical factor to beetle survival.

Intraspecific competition affects brood production. High attack densities result in a more rapid rate of phloem desiccation; consequently, fewer adults emerge per unit area of bark surface. The adults which do emerge will also have a reduced capacity for egg production. Optimum attack densities appear to be between 3 and 10 per 1000 cm2 of lodgepole pine bark surface area, but it depends upon the thickness of phloem (food source). Food supply (phloem) is a main factor in regulating beetle populations. Beetles initially select larger diameter trees with thick phloem, in which populations can increase rapidly. As an infestation progresses and the larger diameter trees have already been killed, smaller trees with thinner phloem are attacked resulting in smaller broods. These trees will also dry out faster, leading to increased brood mortality. In general, when beetles attack trees under 25 cm in diameter, the number of progeny emerging will progressively become less with decreasing diameter.

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Documents attached:

Appendix 4: Minister of Forests' letter of July 28, 1994

Appendix 5: Minister of Forests' memo of February 26, 1996

Appendix 6: Summary of Public Information

File: 10100-01

JUL 28 1994

John Cuthbert
Chief Forester
Ministry of Forests
595 Pandora Avenue
Victoria, British Columbia
V8W 3E7

Dear John Cuthbert:

Re: Economic and Social Objectives of the Crown

The *Forest Act* gives you the clear responsibility for determining Allowable Annual Cuts, decisions with far-reaching implications for the province's economy. The *Forest Act* provides that you consider the social and economic objectives of the Crown, as expressed by me, in making these determinations. The purpose of this letter is to provide this information to you.

The social and economic objectives expressed below should be considered in conjunction with environmental considerations as reflected in the Forest Practices Code, which requires recognition and better protection of non-timber values such as biodiversity, wildlife and water quality.

The government's general social and economic objectives for the forest sector are made clear in the goals of the Forest Renewal Program. In relation to the Allowable Annual Cut determinations you must make, I would emphasize the particular importance the government attaches to the continued availability of good forest jobs and to the long-term stability of communities that rely on forests.

Through the Forest Renewal Plan, the government is taking the steps necessary to facilitate the transition to more value-based management in the forest and the forest sector. We feel that adjustment costs should be minimized wherever possible, and to this end, any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability.

.../2

Province of
British Columbia

Minister of
Forests

Parliament Buildings
Victoria, British Columbia
V8V 1X4

In addition to the provincial perspective, you should also consider important local social and economic objectives that may be derived from the public input on the Timber Supply Review discussion papers where these are consistent with the government's broader objectives.

Finally, I would note that improving economic conditions may make it possible to harvest timber which has typically not been used in the past. For example, use of wood from commercial thinnings and previously uneconomic areas may assist in maintaining harvests without violating forest practices constraints. I urge you to consider all available vehicles, such as partitioned cuts, which could provide the forest industry with the opportunity and incentive to demonstrate their ability to utilize such timber resources.

Yours truly,

Andrew Petter
Minister

Province of British Columbia

Ministry of Forests

MEMORANDUM

File: 16290-01

February 26, 1996

To: Larry Pedersen
Chief Forester

From: The Honourable Andrew Petter
Minister of Forests

Re: The Crown's Economic And Social Objectives Regarding Visual Resources

Further to my letter of July 29, 1994, to your predecessor, wherein I expressed the economic and social objectives of the Crown in accordance with Section 7 of the *Forest Act*, I would like to elaborate upon these objectives as they relate to visual resources.

British Columbia's scenic landscapes are a part of its heritage and a resource base underlying much of its tourism industry. They also provide timber supplies that are of significant economic and social importance to forest industry dependent communities.

Accordingly, one of the Crown's objectives is to ensure an appropriate balance within timber supply areas and tree farm licence areas between protecting visual resources and minimizing the impact of such protection measures on timber supplies.

As you know, I have directed that the policy on management of scenic landscapes should be modified in light of the beneficial effects of the Forest Practices Code. In general, the new policy should ensure that establishment and administration of visual quality objectives is less restrictive on timber harvesting. This change is possible because alternative harvesting approaches as well as overall improvement in forest practices will result in reduced detrimental impacts on visually sensitive areas. Also, I anticipate that the Forest Practices Code will lead to a greater public awareness that forest harvesting is being conducted in a responsible, environmentally sound manner, and therefore to a decreased public reaction to its visible effects on the landscape. In relation to the Allowable Annual Cuts determinations that you make, please consider the effects that the new policy will have in each Timber Supply Area and Tree Farm Licence.

.../2

In keeping with my earlier letter, I would re-emphasize the Crown's objectives to ensure community stability and minimize adjustment costs as the forest sector moves to more value-based management. I believe that the appropriate balance between timber and visual resources will be achieved if decisions are made consistent with the ministry's February 1996 report *The Forest Practices Code: Timber Supply Analysis.*

Finally, in my previous letter I had asked that local economic and social objectives be considered. Please ensure that local views on the balance between timber and visual resources are taken into account within the context of government's broader objectives.

Andrew Petter
Minister of Forests

Quesnel Timber Supply Area
Timber Supply Review

Summary of Public Input

BC Ministry of Forests
Quesnel Forest District
322 Johnston Ave.
Quesnel, BC
V2J 3M5

March, 2001

This is a summary of the public input received on the Timber Supply Review in the Quesnel Timber Supply Area. This summary does not assess the feasibility or validity of the input or whether it relates to the clearly defined mandate of the chief forester in the allowable annual cut determination.

Quesnel Timber Supply Area

Background

As part of the review of timber supply in the Quesnel Timber Supply Area (TSA), two opportunities were provided for public input. The first followed release of the Quesnel Timber Supply Area *Data Package* and *Information Report* in June 1999. The *Information Report* was a non-technical summary of the draft data and management assumptions that were to be applied in reviewing the timber supply for the Quesnel TSA. A 30-day review period, ending July 30,1999, was provided for the public to comment on these documents.

On February 15, 2001, as part of the scheduled Timber Supply Review and in response to the urgent beetle epidemic in the Quesnel TSA, the British Columbia Forest Service released the *Quesnel Timber Supply Area Analysis Report and Information for Urgent Allowable Annual Cut Increase.* The public was encouraged to review and comment on the accuracy of the information in this document and to provide additional information during the 21-day review period that ended March 8, 2001. Because of the urgent nature of the beetle epidemic, the usual 60-day public review period was shortened to 21 days.

This report summarizes the input received during both public review periods. This information was provided to the chief forester for his consideration when he reviewed the allowable annual cut (AAC) for the Quesnel TSA. The first section of this summary outlines the public review process implemented by the Forest Service, and describes the types of public input received. The second section summarizes the public input in sufficient detail to indicate the range of input received. The original submissions (with personal identifiers removed in accordance with the *Freedom of Information and Protection of Privacy Act*) can be reviewed at the Quesnel Forest District office.

Public Review Process and Response

Quesnel District staff actively solicited public input on the Timber Supply Review in the Quesnel TSA through the following actions:

- direct mail-out of about 70 copies of the *Information Report*, *Data Package* and *Analysis Report and Information for Urgent Allowable Annual Cut Increase* to local governments and MLAs, First Nations, licensees, forest workers, environmental groups, ranchers, consultants and interested individuals in the Quesnel TSA or adjacent timber supply areas.
- the *Data Package* and the *Analysis Report* were available at the district office in Quesnel and the regional office in Williams Lake.
- a meeting regarding the *Data Package* and the *Information Report* was held with representatives from the Quesnel TSA Major Licensees' Association (about 15 attendees).
- an open house was held at the district office in July 1999 following the release of the *Data Package* and *Information Report* (five attendees).
- a meeting was held with the Quesnel Chamber of Commerce on Feb. 8, 2001, to discuss the *Analysis Report* (40 attendees).
- the Timber Supply Review documents were discussed with the local MLA.
- copies of the documents were provided to the local media. Newspaper and radio interviews were given when the *Analysis Report* was released.
- newspaper advertisements were placed, advising of the availability of the documents for review by the public.

The Quesnel Forest District received three written submissions on the *Data Package* and nine submissions on the *Analysis Report* (see Appendix 1).

Quesnel Timber Supply Area

Public Input

In this section, public input on the information presented in the Timber Supply Review documents for the Quesnel TSA is summarized under the following headings:

- Data Package (and Information Report)
- Timber Supply Area Analysis Report and Information for Urgent AAC Increase
- Other comments

Data Package

Land Base Factors
The submission from the Quesnel TSA licensees raises a number of issues about the definition of the operable land base. Their points include the following:

- they question to what extent the Cariboo Chilcotin Land Use Plan (CCLUP) has been incorporated, particularly its definition of productive land base.
- they question whether it is the intent to update Environmentally Sensitive Areas and/or to increase use of terrain stability mapping.
- they question the reduction in area of problem forest types (PFTs).
- since a significant portion of existing deciduous-leading stands naturally convert to coniferous-leading stands, they say a deferral with an appropriate regeneration delay would be more appropriate, rather than exclusion of these stands.
- they express disagreement with the exclusion of various stands as being unmerchantable, saying harvesting performance in many of these stands can be demonstrated.
- with regard to low productivity sites, they say exclusions must be based on current performance not on modelling constraints.

Regeneration Delay
The licensees' submission questions the regeneration delay used, saying that although licensees may report a seven-year delay, in actuality it is often less than that. The licensees offer to work with district staff to arrive at more realistic numbers.

Forest Cover Constraints
The licensees' submission says the data packages in other TSAs have recognized the role of forests outside the timber harvesting land base in meeting cover requirements, and asks if this is the case in the Quesnel TSA.

The licensees also question the forest cover constraints in the Cariboo River Wildlife Management Area. They say a forest development plan has been completed and approved for this area and no such constraints were anticipated, nor were they contemplated in the original agreement signed in 1990.

Cultural Sites
The Lhoosk'uz Dene submission says the Traditional Use Study done in the Quesnel TSA was a pilot project and a more extensive and comprehensive study must be completed as soon as possible. Of the sites identified, this submission says seven sacred sites and 32 spiritual sites are of high concern and assurance is needed they will be protected, as well as the other traditional use and archaeological sites. The Lhoosk'uz Dene say if forest development is to occur, it is imperative that Archaeological Impact Assessments be done in cooperation with them.

Wildlife and Riparian Areas
The licensees ask for information on the proportion of arboreal vs. terrestrial lichen management prescriptions that will be modelled for western caribou. They also ask what boundaries are used for western caribou habitat areas.

The licensees ask whether the mapsheets used to determine riparian management areas were a representative sample of the TSA. They also question why a reduction is applied to the land base for Riparian Management Zones, saying licensees should have access to all the

volume from within these zones, to be managed over one rotation. The licenses say a different methodology (e.g., varying the number of passes or applying cover constraints) would better approximate current practice in these zones.

Blackwater LRUP
The licensees question the source of the statement that ten per cent of zone 1 is available for harvesting, and also ask for clarification of the status of the Local Resource Use Plan.

Biodiversity
The licensees question how Wildlife Tree Patches (WTPs) are modelled and express concern about double-counting. For example, they say unmerchantable areas already removed from the timber harvesting land base often serve as suitable WTPs and this could also be true for other constraints. This submission also asks why the statement is made that 95 per cent of WTPs are larger than two hectares.

The Lhoosk'uz Dene submission says the ongoing interruption in the process of succession, which began with fire suppression and continues with clearcutting, the use of biocides and lodgepole pine silviculture prescriptions, is a problem for biodiversity maintenance. This submission says diversity must include people, as they are part of the forest and the land.

Kluskus Supply Block
The licensees state agreement with the treatment of this supply block in a sensitivity analysis. They say the wording on page 6 of the *Information Report* is incorrect; rather than saying licensees are not proceeding with development, it would be more appropriate to say that attempts at harvesting have not been successful but that a cutting permit has been issued.

The Lhoosk'uz Dene submission refers to the 1996 *Rationale Statement* and the chief forester's recommendations regarding the Kluskus supply block. The First Nation says no harvesting has occurred and they are determined none will occur without their meaningful participation. The Lhoosk'uz Dene recommend the Kluskus harvest be partitioned.

Proposed Facilities
Reko Log Homes says they are building a facility to make laminated panels out of pine and birch, and furniture cut stock from birch. Reko notes the opportunity for a variety of aspen products for export, and hopes this wood will be made available.

Socio-economic Factors
The Lhoosk'uz Dene say the economic and social objectives of the Crown should be clearly and publicly stated, and they request further information. The First Nation says the Crown's objectives should include economic parity (between aboriginal and non-aboriginal communities); respect for traditional aboriginal economies and cultures; regional economic diversification; and, enhanced biodiversity.

The Lhoosk'uz Dene say the aboriginal economy needs to be respected, protected and enhanced, and this is partly achieved through the protection of diversity. This submission refers to the so-called Moose Study that assessed the value of income-in-kind and commodity items provided by the land. As well, the Lhoosk'uz Dene say aboriginal sustenance uses will impact timber supply but no allowances have been made to accommodate this.

Analysis Report and Information for Urgent AAC Increase

Land Base Factors
The submission from the Carrier Chilcotin Tribal Council says they don't agree it's not possible to assess whether the timber harvesting land base has been over- or under-estimated. The submission points to several factors that

suggest the land base has been overestimated, such as sacred and traditional use sites, the caribou strategy, riparian areas, ungulate ranges, etc.

A submission from Slocan Forest Products (SFP) says management of problem forest types (PFTs) should be considered in concert with any initiative to deal with the mountain pine beetle infestation. The company says they've been working on an initiative to assess harvest opportunities in PFTs and provide an outline of a proposal to increase the harvest in PFTs by about 100,000 cubic metres annually, from the current harvest level of 300,000 cubic metres. The company's rationale includes the following points:

- the increase would mitigate the effect of an AAC falldown in 20 years that may result from an accelerated harvest of pine beetle infestations;
- SFP has available and under-utilized mill capacity for small wood;
- SFP has demonstrated harvest performance in PFTs; and,
- the Timber Investments Strategy Committee's report indicated a potential three to five per cent gain in harvest could be achieved by increasing the PFT harvest.

An individual submission says the use of deciduous species needs research.

Timber Requirements
The tribal council submission urges the chief forester to not simply consider current mill capability or lumber production, as the future may be different. The tribal council says value-added wood does not have difficulty with the Softwood Lumber Agreement, and notes that two local businesses with a large market rely on naturally dry wood, which will be harder to access with an increase in harvesting green attack timber.

Socio-Economic Factors
The tribal council submission questions the revenue figures in the report, and asks what the costs and net benefits in cash terms would be from an increased harvest. The submission says increasing lumber exports to the U.S. will increase the likelihood of a countervail, noting their understanding that most of the wood from the Quesnel TSA goes to the U.S.

A submission from the District of Wells notes their heavy reliance on tourism and questions how tourism targets, included in the Cariboo Chilcotin Land Use Plan, are being met in the TSA and how they will be impacted by any changes to the AAC.

Other Comments

Most submissions commented on factors or issues other than those specifically covered by Timber Supply Review documents. These comments are summarized in this section.

Timber Supply Review Process
The Lhoosk'uz Dene submission says they assert aboriginal title to the area in question and the taking of resources from their land is a violation of title which they do not consent to. This submission says the Lhoosk'uz Dene do not have the capacity to properly consider the Timber Supply Review documents and require financial assistance to do so. The submission refers to the Delgamuukw decision and asks how aboriginal priority has been taken into account and how the provincial government and third parties intend to address the issue of compensation for infringement of title. References and selected reports pertaining to timber supply are provided.

The District of Wells notes they did not receive Timber Supply Review information directly and asks to be put on the mailing list. An individual submission requests an extension of the public review period, saying it's a travesty that such an important analysis should have such a hushed, short review period.

Allocation
An individual submission says small business

sales need to be increased to bring more small operators into business, noting that small patch beetle logging suits small business. This submission also says large corporations should not be allowed to back small operations' bids and an open timber auction is needed.

Harvest Levels

Three submissions express support for an AAC increase to salvage beetle-killed wood and bring the infestation to a manageable level. Their reasons include:

- it will increase employment and allow further diversification of employment to proceed;
- 60 per cent of the THLB is susceptible to mountain pine beetle attack and thus the future timber supply in the TSA is threatened; and,
- the current AAC has not been able to decrease the magnitude of the infestation.

The District of Wells expresses concern that an AAC increase would negatively affect tourism targets in their area and particularly within the Quesnel Highlands Special Resource Management zone.

The Carrier Chilcotin Tribal Council says the proposed increase is clearly unsustainable, noting it is 43 per cent higher that the previously estimated long-term harvest level that preceded the CCLUP and its subsequent plans and strategies. The tribal council says the increase will lead to an economic boom that will be difficult to scale back, noting that in Williams Lake the mountain pine beetle harvest hasn't been scaled back for over two decades.

The Quesnel Environmental Society says it disagrees with the proposed increase, offering the following reasons:

- it's a reaction not a solution to an ongoing problem that natural processes have historically taken care of;
- the falldown will come sooner;
- the TSA will become another producer of smaller and younger fibre; and,
- more jobs are not guaranteed, given increasing mechanization and more raw logs leaving to be processed elsewhere.

The TSA Licensees Association says the harvest level falldown after 20 years, shown in the mountain pine beetle harvest forecasts, can be mitigated through other opportunities such as reduced regeneration delay, genetically improved stock, juvenile spacing, fertilization, etc. The association says the analysis should reflect these cumulative potential uplifting factors, particularly the application of the results of the Old Growth Site Index study.

Appendix 1

Submissions received by the Quesnel Forest District

Submissions received on the Data Package

Forest industry

Quesnel TSA Major Licensees' Association (Weldwood of Canada, Tolko Industries, West Fraser Mills, Slocan Forest Products, C&C Wood Products)

Reko Industries Ltd.

First Nations

Lhoosk'uz Dene Government Administration

Submissions received on the Timber Supply Analysis Report

Forest industry

Quesnel TSA Major Licensees' Association (Weldwood of Canada, Tolko Industries, Slocan Forest Products, Canadian Forest Products, C&C Wood Products, West Fraser Mills)

Slocan Forest Products Ltd.

Local government

District of Wells, Mayor Hendrixson

First Nations

Carrier Chilcotin Tribal Council, Bert Groenenberg

Interest groups

Quesnel Environmental Society

North Cariboo Share Our Resources Society

General public

Three individual submissions